

Armed Forces College of Medicine

AFCM

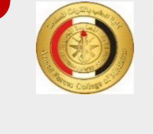


External Features of the Spinal Cord

:By

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INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture the student will be able to:

1. **List the <u>components of the nervous system</u>.**
2. **List the <u>beginning, termination, shape, meninges and supportive ligaments</u> of the spinal cord.**
3. **Find the relation between <u>the segments of the spinal cord</u> and <u>the overlying vertebral column</u> and identify its clinical importance.**
4. **Compare between <u>the exit of spinal nerves</u> in relation to the vertebrae.**
5. **Describe <u>the technique of lumbar puncture</u> and list its purposes.**
6. **Identify <u>the internal structure of a T.S.</u> of the spinal cord; grey matter & white matter.**
7. **Describe <u>the attachment</u> of the spinal nerves.**
8. **List the <u>various columns</u> of the white matter of the spinal cord.**

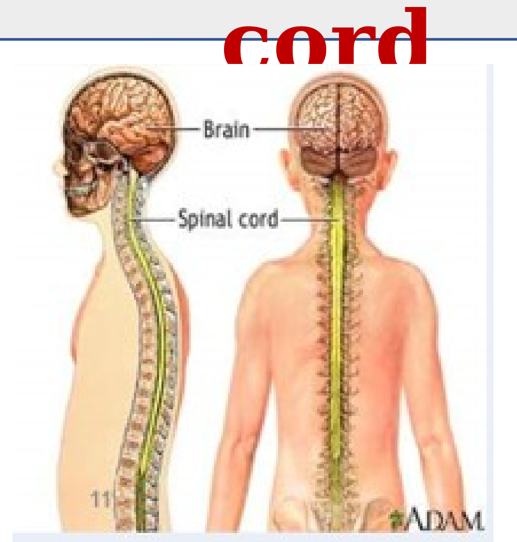
Lecture Plan



1. **Part 1 (5 min): Introduction to the Nervous system.**
2. **Part 2 (20 min): External features, meninges and supportive ligaments of the spinal cord + Lumbar puncture.**
3. **Part 3 (20 min): Internal structure of the spinal cord + attachments of the spinal nerves.**
4. **Part 4 (5 min): Summary.**

Divisions of the Nervous System

Central Nervous System
(CNS)
Brain and spinal cord



Peripheral Nervous System
(PNS)

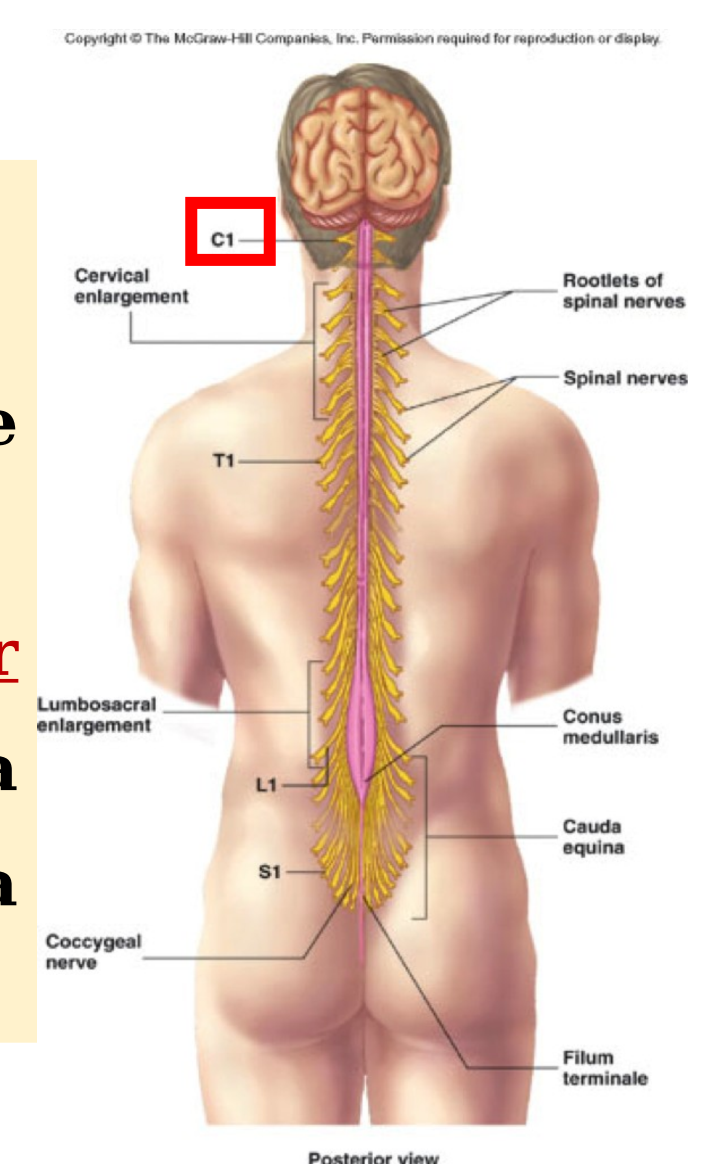
Somatic Nervous System

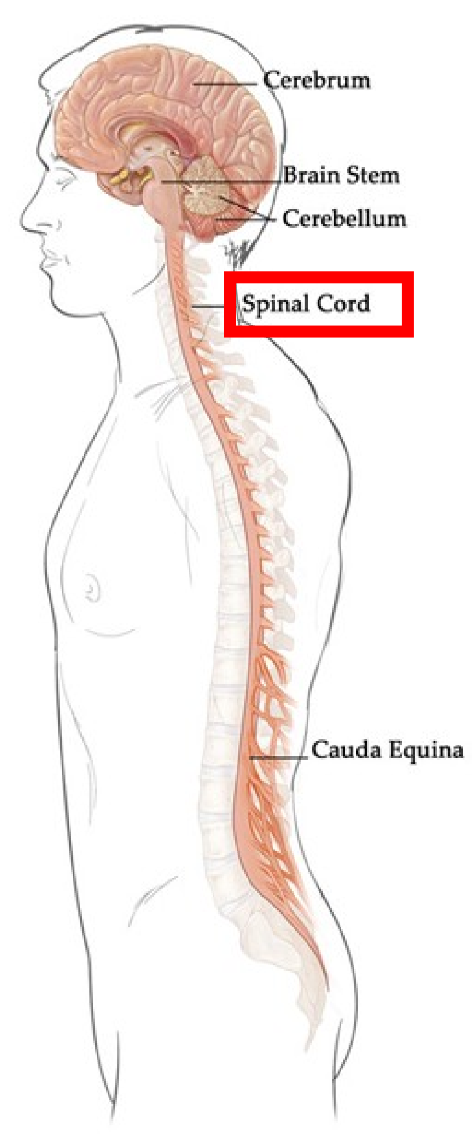
Autonomic Nervous System
(ANS)

The Spinal Cord

➢Site:

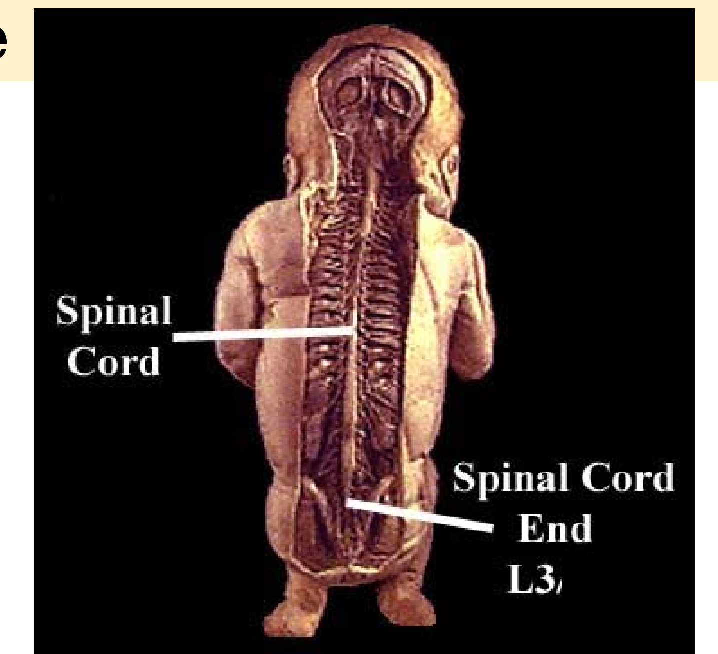
- **Occupies the upper 2/3 of the vertebral canal.**
- **Begins opposite the upper border of Atlas vertebra, as a continuation of the medulla oblongata.**

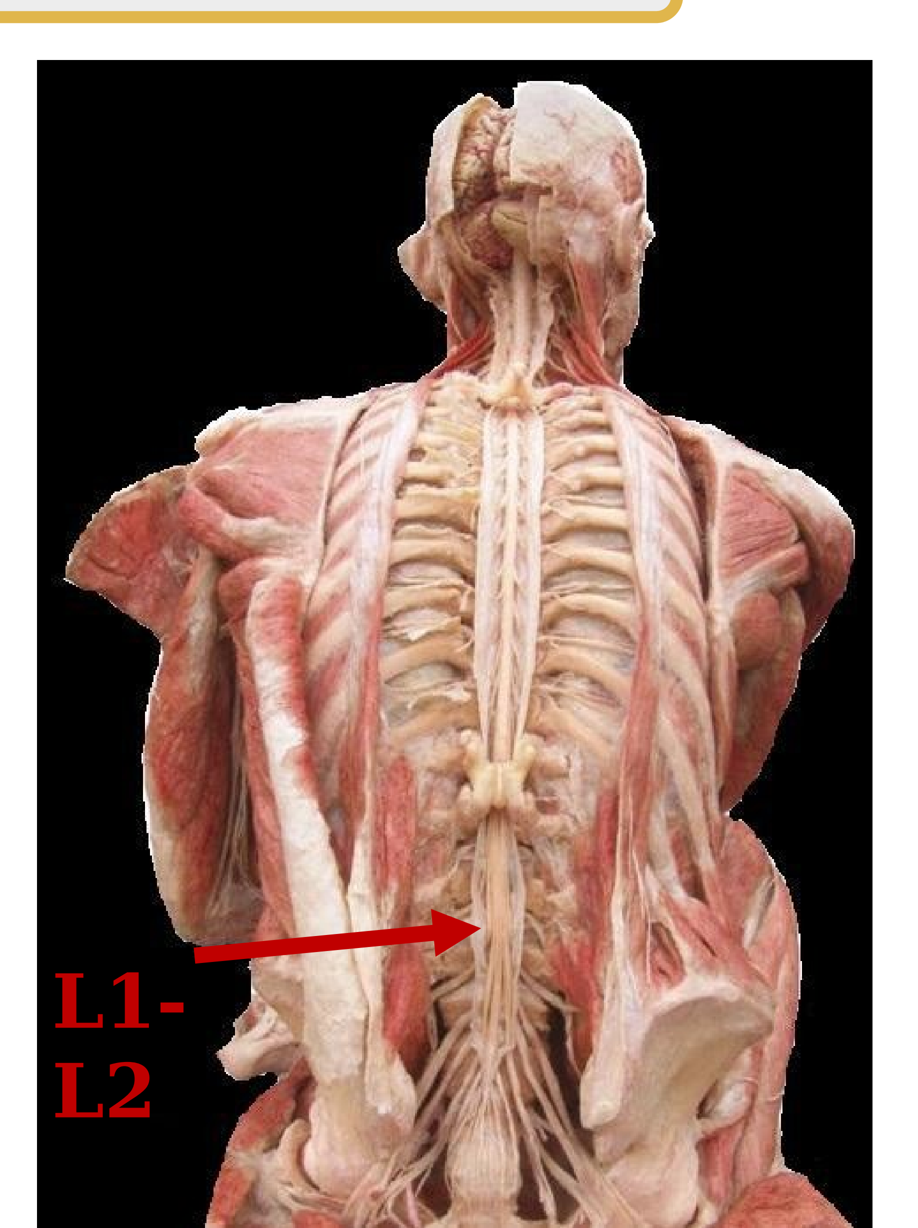




The Spinal Cord

- **Ends opposite the disc between L1 & L2 in adults.**
- **At birth, it ends opposite L3.**
- **Later, the vertebral column grows faster than the**





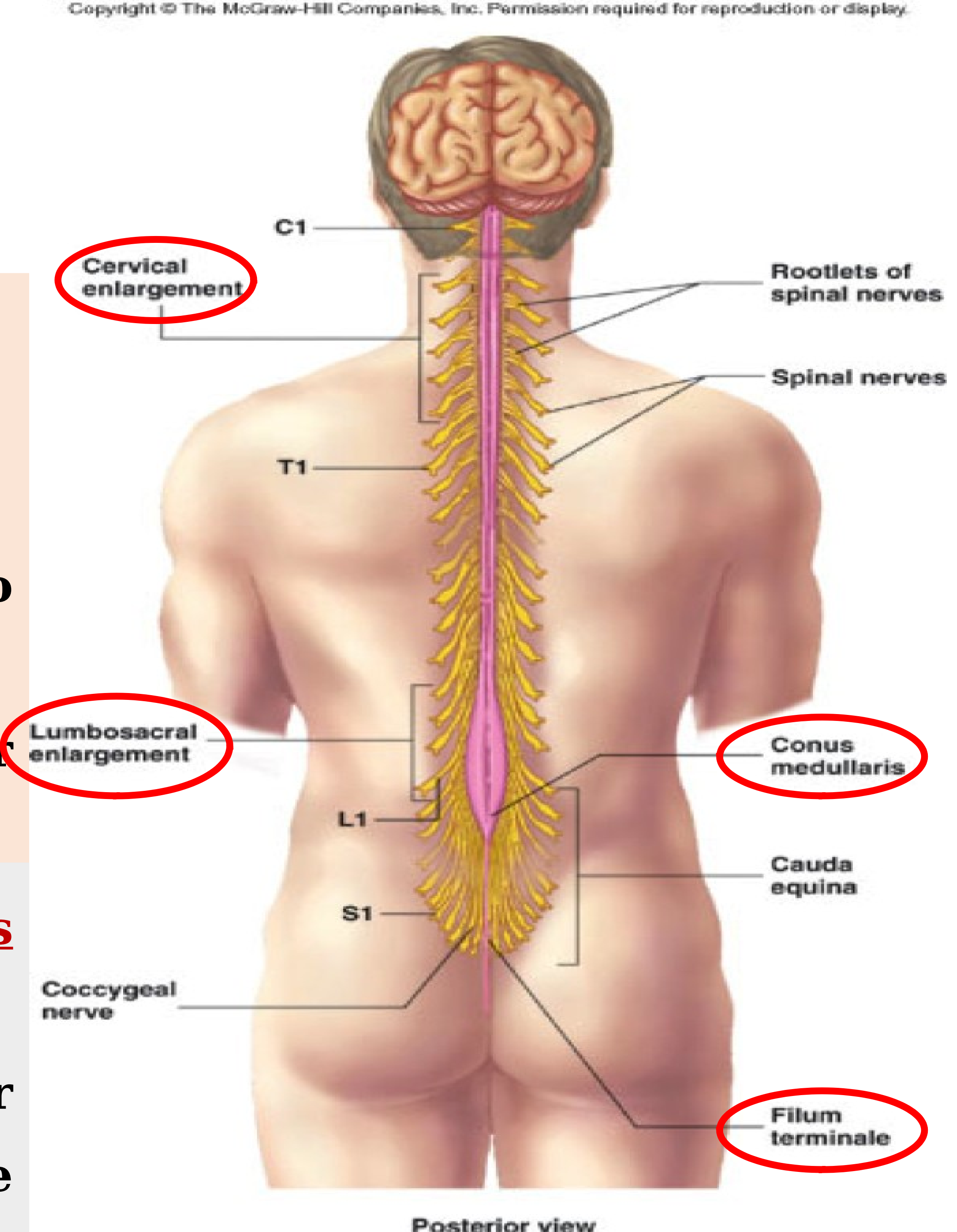
The Spinal Cord

- **Length** = **45 cm.**
- **Shape: cylindrical but shows:**
- **2 enlargements**

1. *Cervical enlargement* gives origin to brachial plexus (C4-T1)

2. *Lumbar enlargement* gives origin to lumbar & sacral

- **A tapering lower end called conus medullaris.**
- **From its apex, a thin filament of pia mater called filum terminale extends down to be**



The Spinal Cord

The cord is divided into segments (31 segments) giving rise to 31 pairs of spinal nerves:

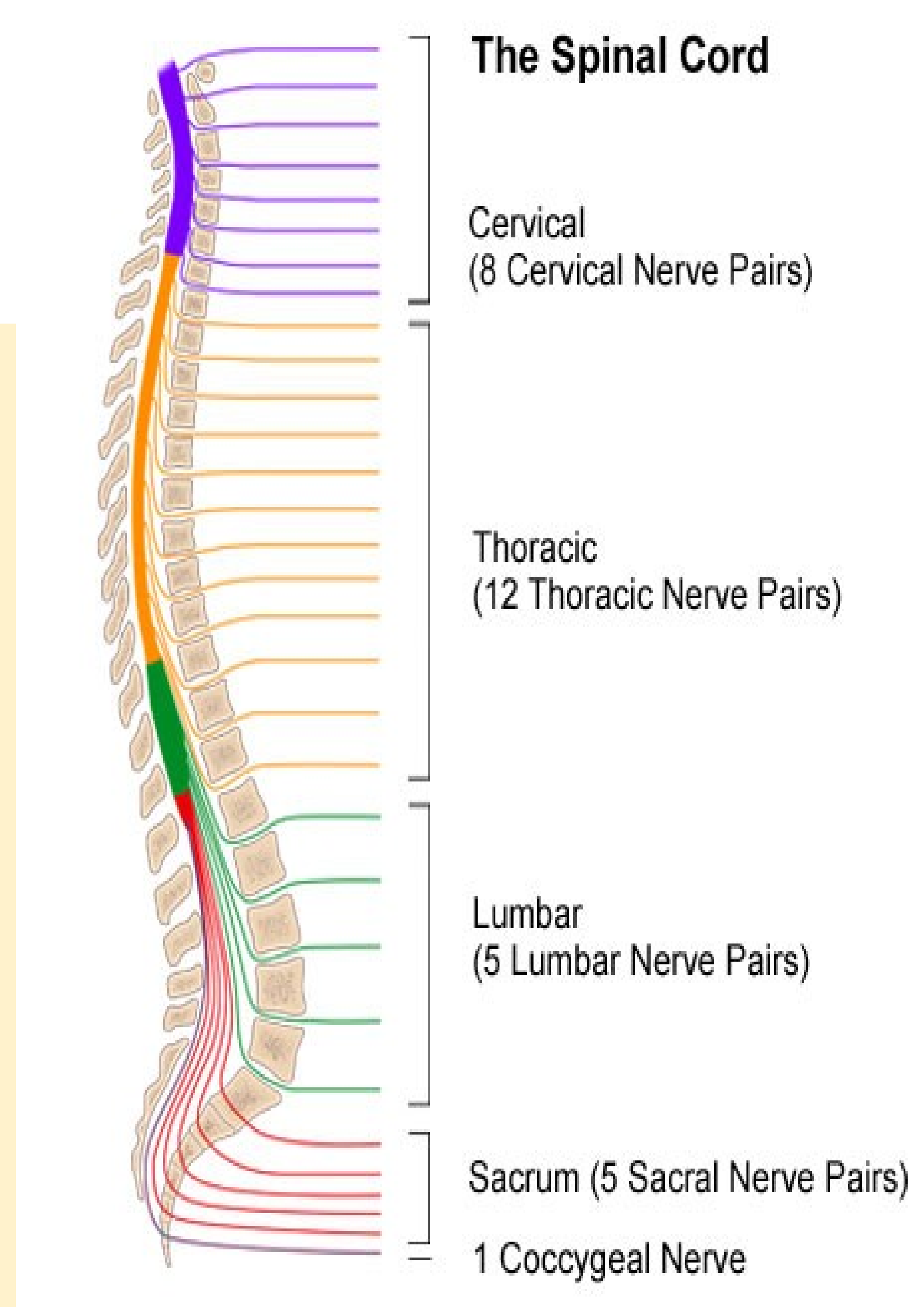
A- Cervical segments : 8

B- Thoracic segments: 12.

C- Lumbar segments: 5.

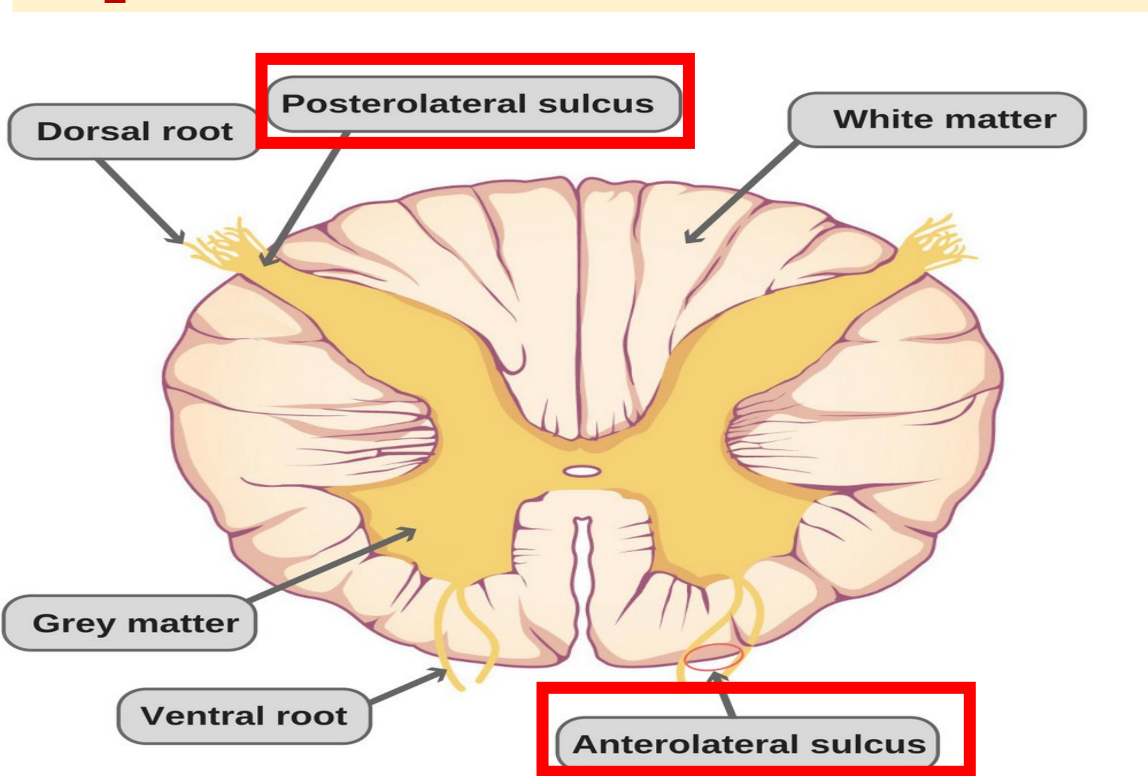
D- Sacral segments: 5.

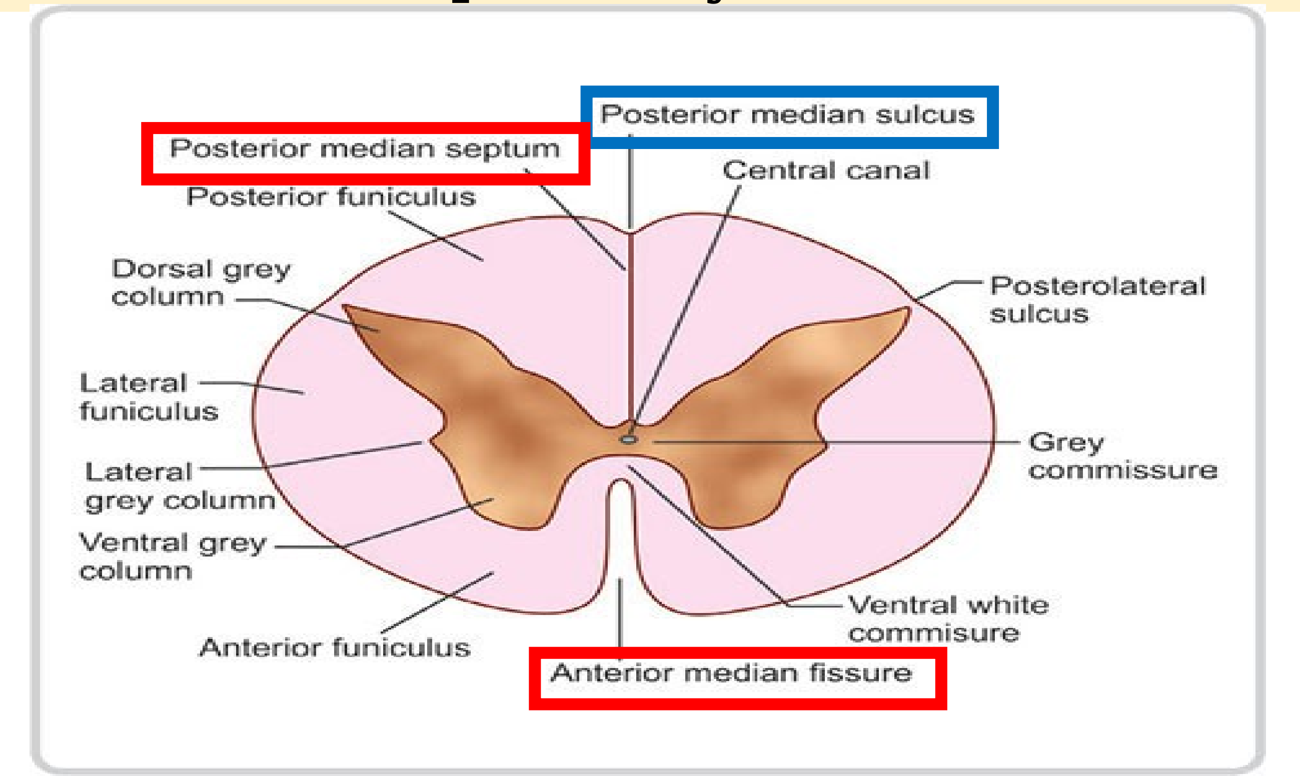
E- Single coccygeal segment.



Longitudinal Grooves of the Spinal Cord

- An **anterior median fissure** & a **posterior median septum** divide the cord almost completely into **right and left halves**.
- In addition, **2 posterolateral & 2 anterolateral sulci** give attachment to **posterior & anterior roots** of spinal nerves respectively.

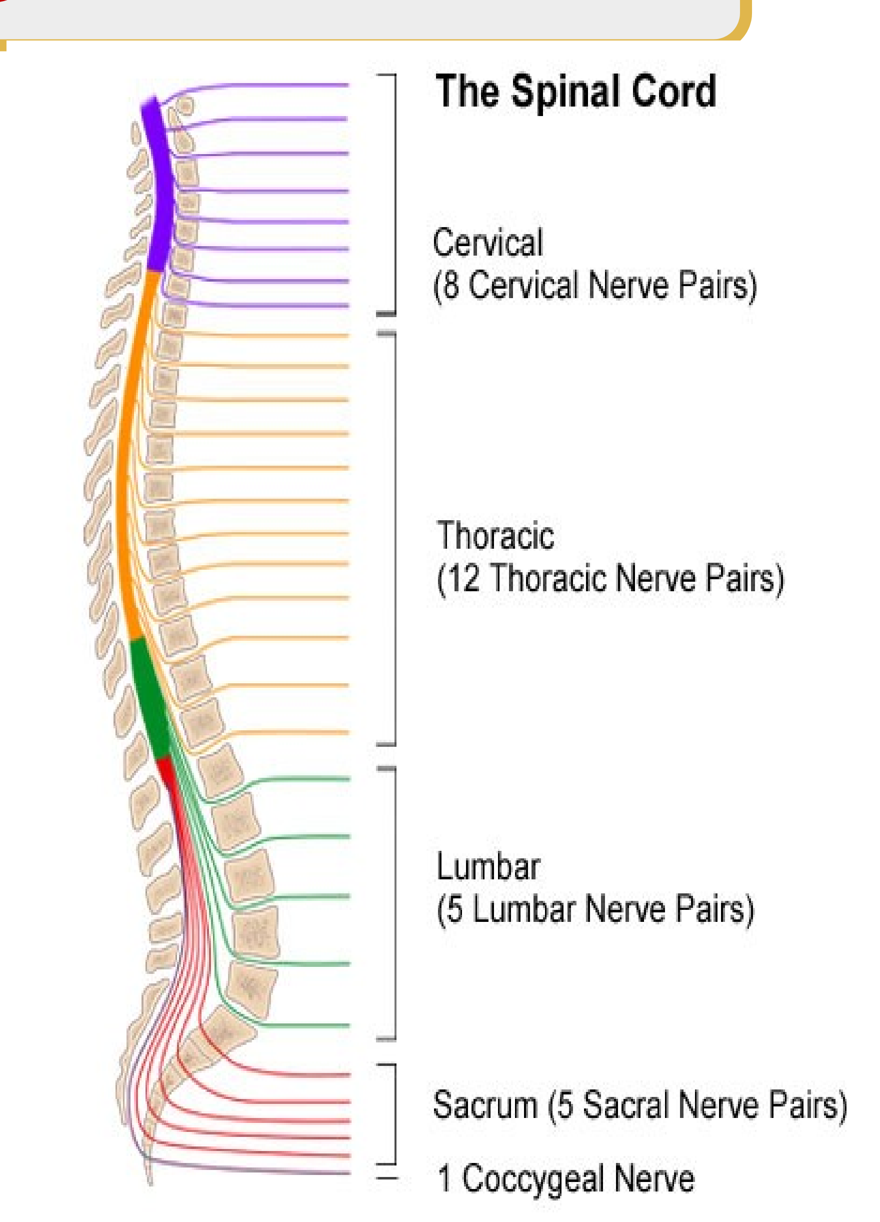




Levels of the Spinal Segments

Spinal cord segments do not lie opposite the corresponding vertebrae

- **In the cervical region, subtract one from the number of spinal cord segment to get the corresponding vertebra (e.g., C6 segment is opposite C5 vertebra)**
- **In the upper 6 thoracic segments subtract 2 (e.g., T6 segment is opposite T4 vertebra)**
- **In the lower 6 thoracic segments subtract 3 (e.g., T12 segment is opposite T9 vertebra)**
- **In the lumbar segments subtract 4 (e.g., L5 is opposite L1 vertebra).**



Lecture Quiz

A patient is suffering from a lesion in the fifth cervical segment; fracture dislocation of which of the cervical vertebrae is most likely causing the lesion?

A- C3

B- C4

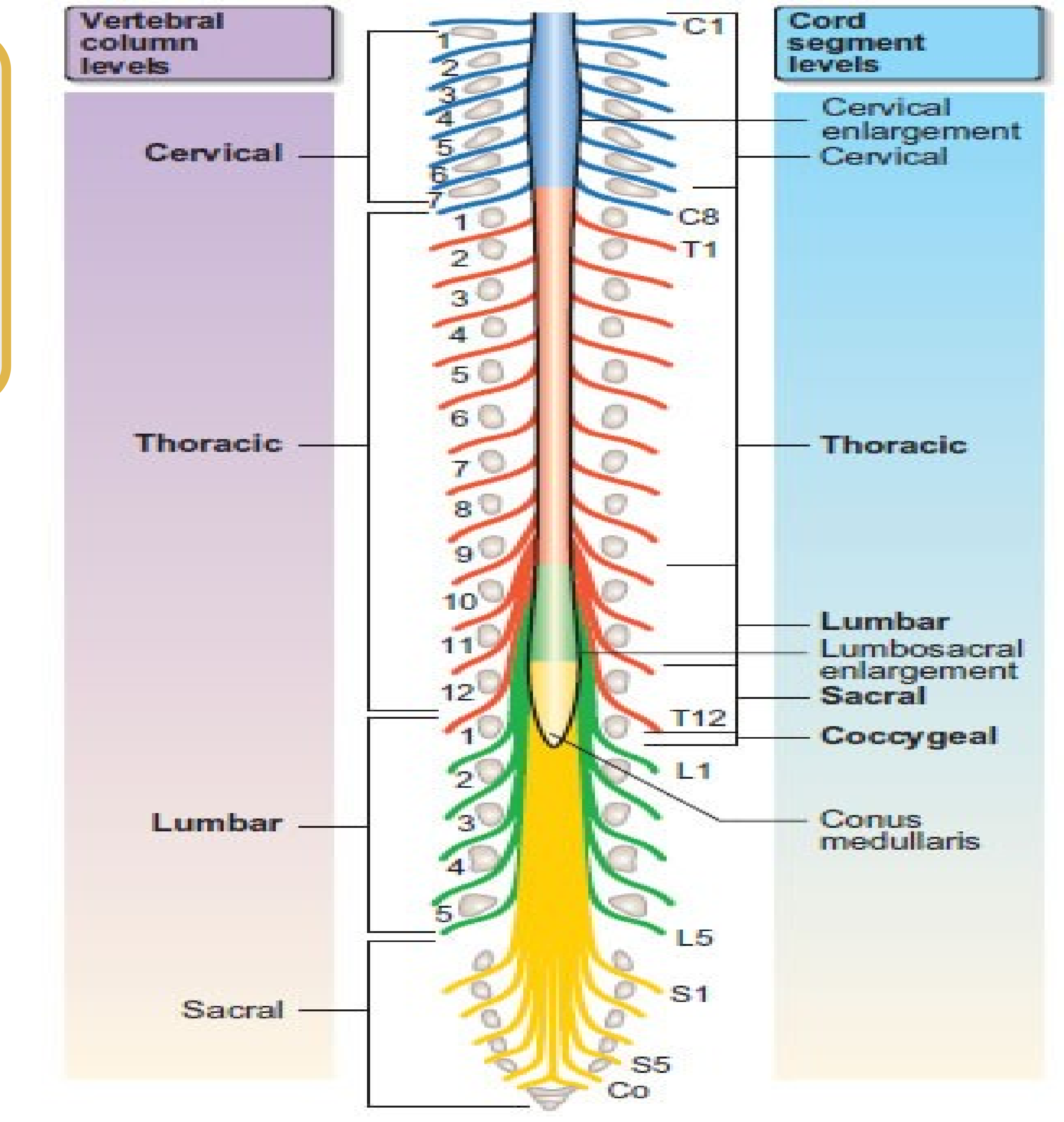
C- C5

D- C6

E- C7

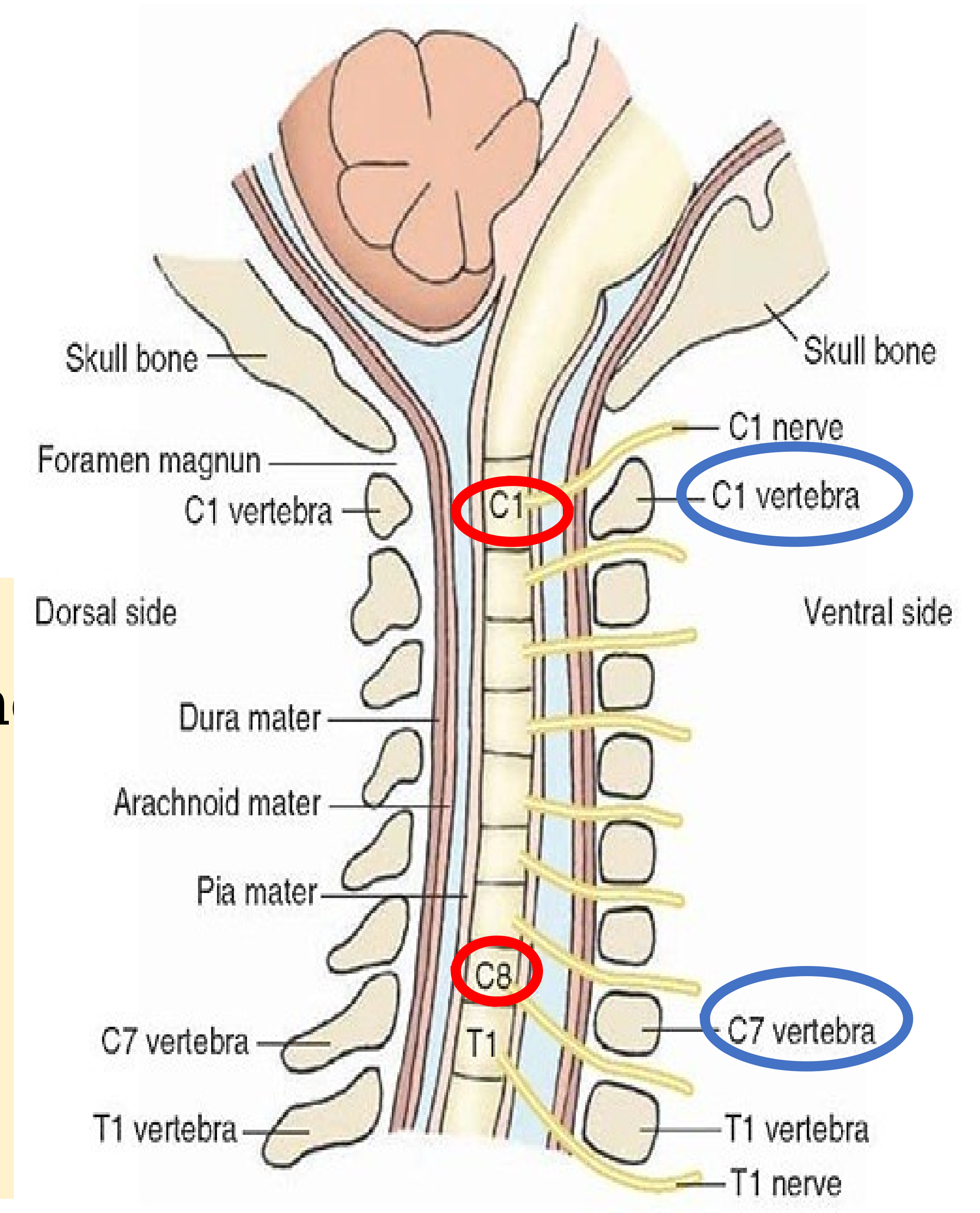
Direction of the Roots of the Spinal Nerves

- **C1&2 are <u>horizontal</u>**
- **C3-T12 are <u>oblique</u>**
- **L1-Co are <u>vertical</u>**



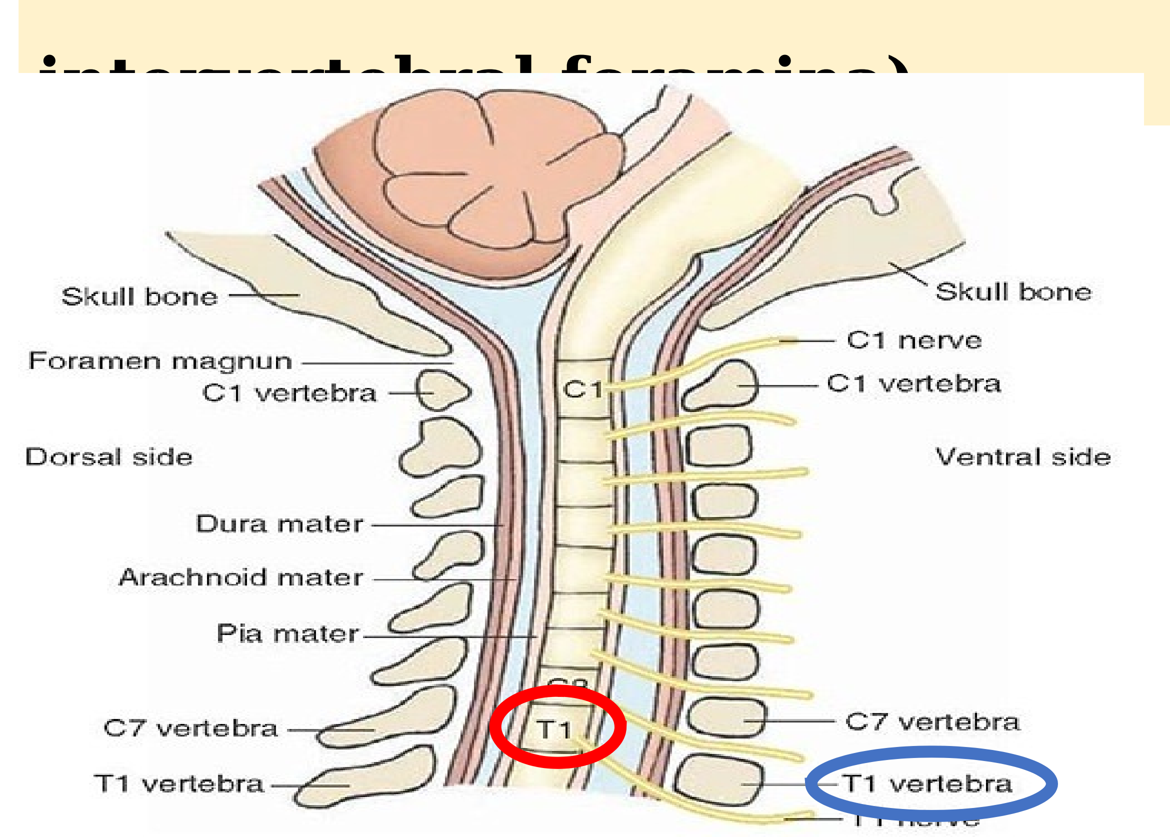
Exit of the Spinal Nerves from the vertebral Canal

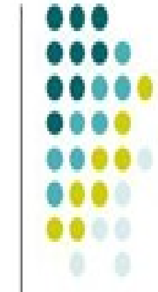
- **C1-7 pass <u>above</u> correspondin[g] vertebrae.**
- **C8 passes <u>below</u> C7 vertebra.**

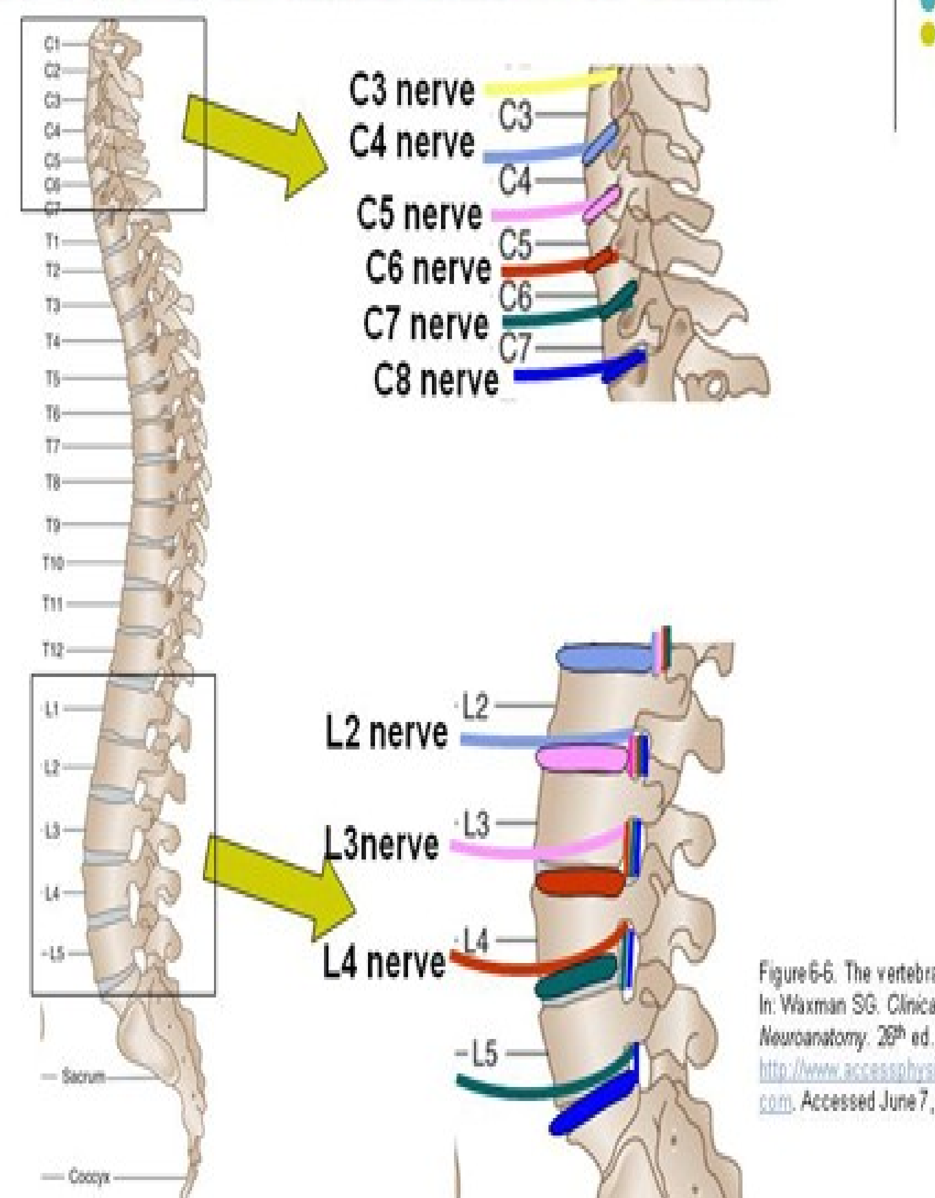


Exit of the Spinal Nerves from the vertebral Canal

T1-L5 pass below corresponding vertebra. (C2-L5 exit via intervertebral foramina)

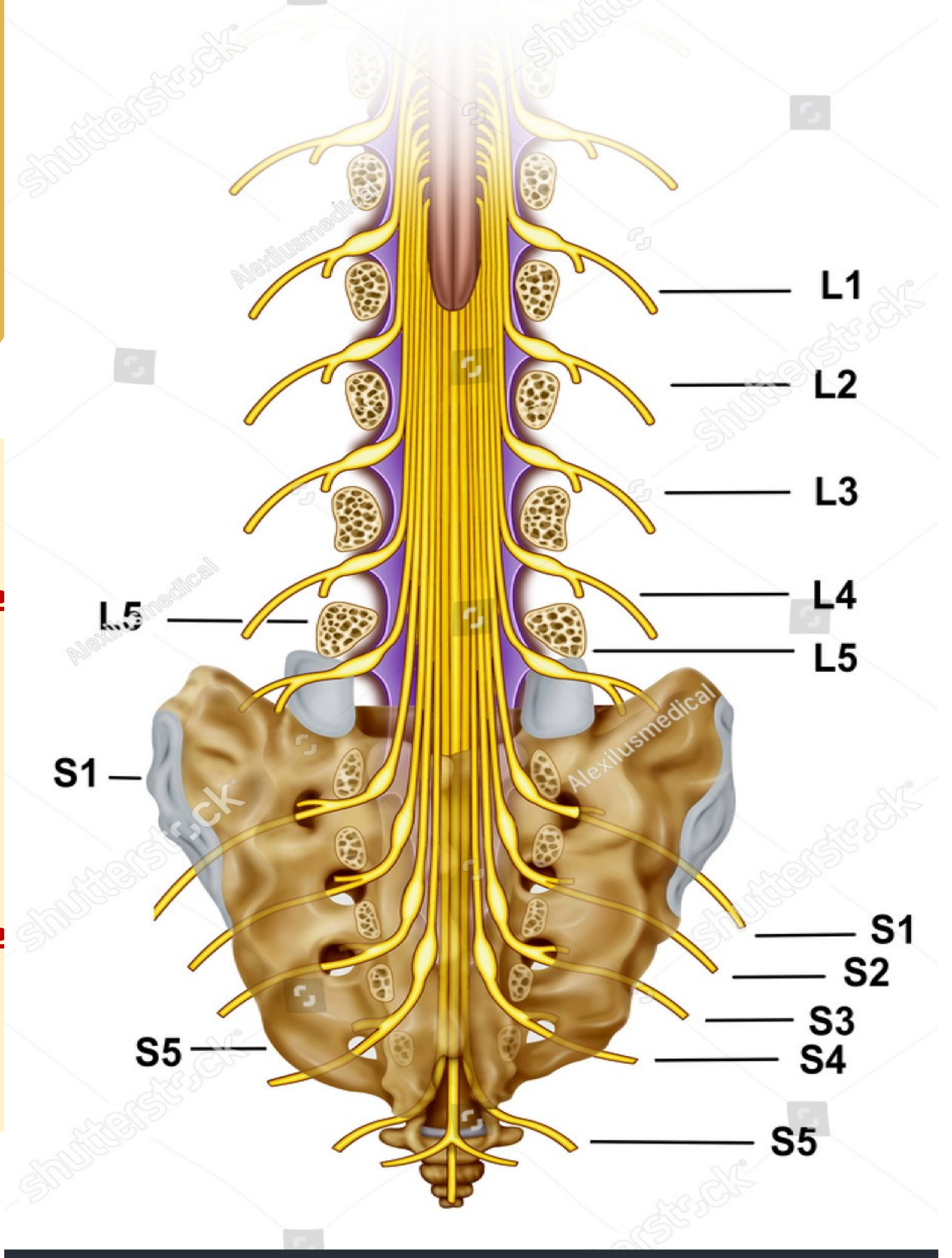






Exit of the Spinal Nerves from the vertebral Canal

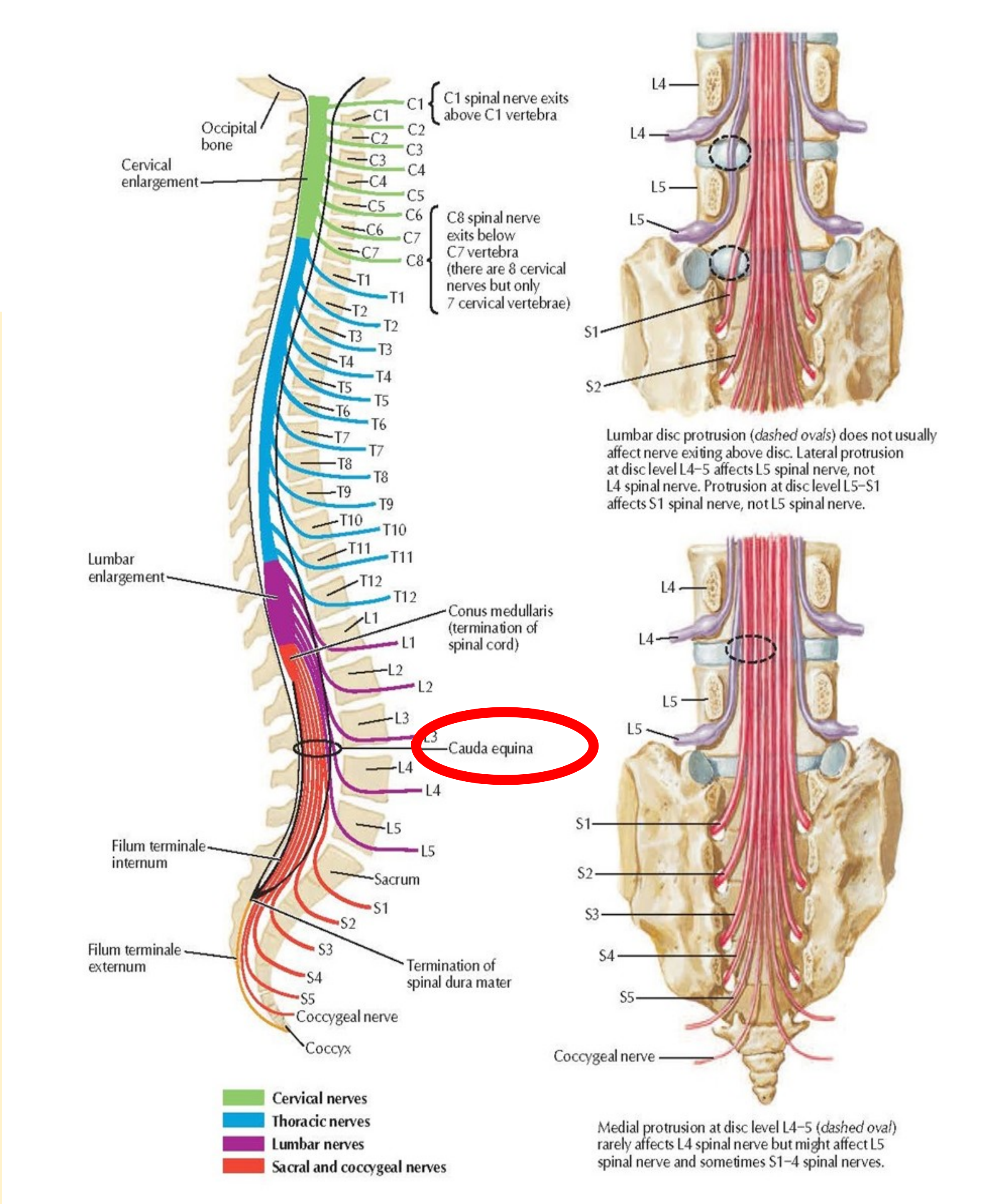
- S1-4 pass via the ant. & post. sacral foramina.
- S5 & Co pass via the sacral hiatus.



Exit of the Spinal Nerves from the vertebral Canal

- **The collection of spinal nerves that surround the filum terminale below the termination of the spinal cord (i.e., below L2) is called cauda equina because it resembles a horse tail.**

- **They occupy the lower 1/3 of the vertebral canal & the sacral canal.**

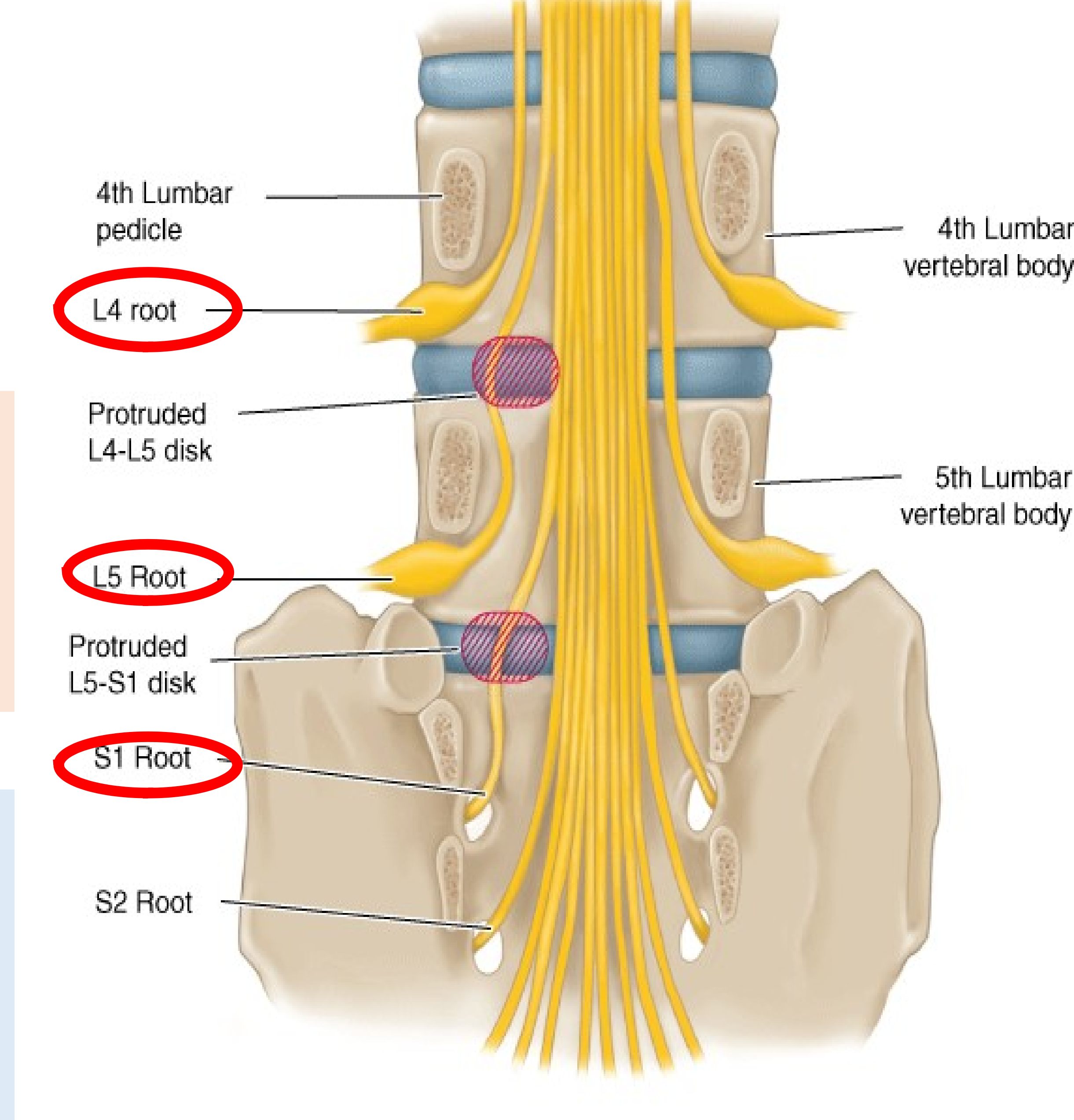


Applied Anatomy: Nerve Compression

➢ **<u>The size</u> of the <u>spinal nerves increases</u> gradually from above downwards.**

➢ **Meanwhile, <u>the size</u> of the intervertebral <u>foramina</u> <u>decreases</u> from above downwards.**

➢ **The <u>4th & 5th lumbar nerves are</u>**



The Spinal Cord

The spinal cord is

covered by

3 meninges:

1- Dura matter (the outer layer)

2- Arachnoid (middle



Denticulate ligament

Subarachnoid space

Subdural space

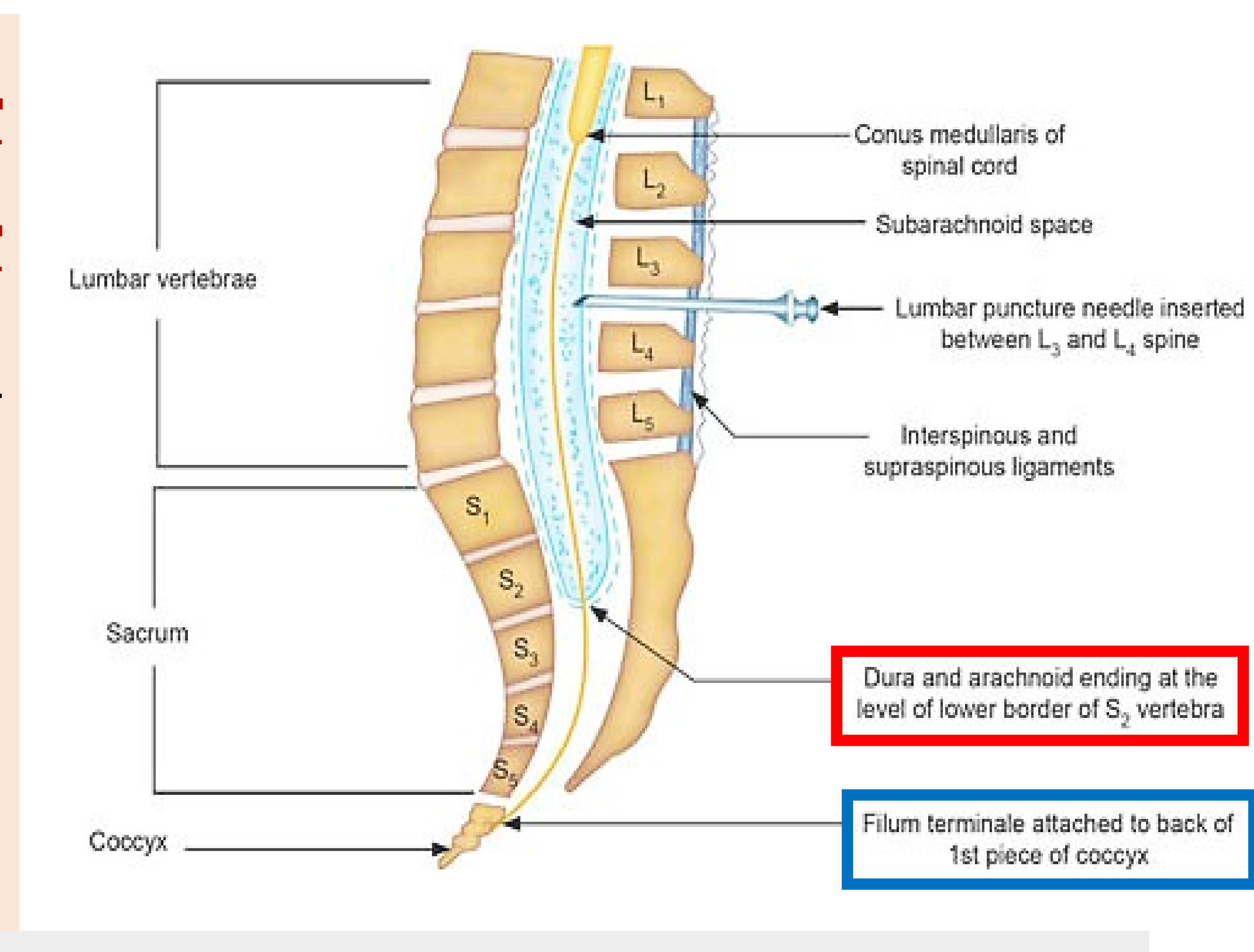
Pia

Arachnoid

Dura

1. **The dura mater (outer layer) & arachnoid mater (middle layer)** form **one tube** together.

- **Above**, it continues with the cerebral meninges at the foramen magnum.



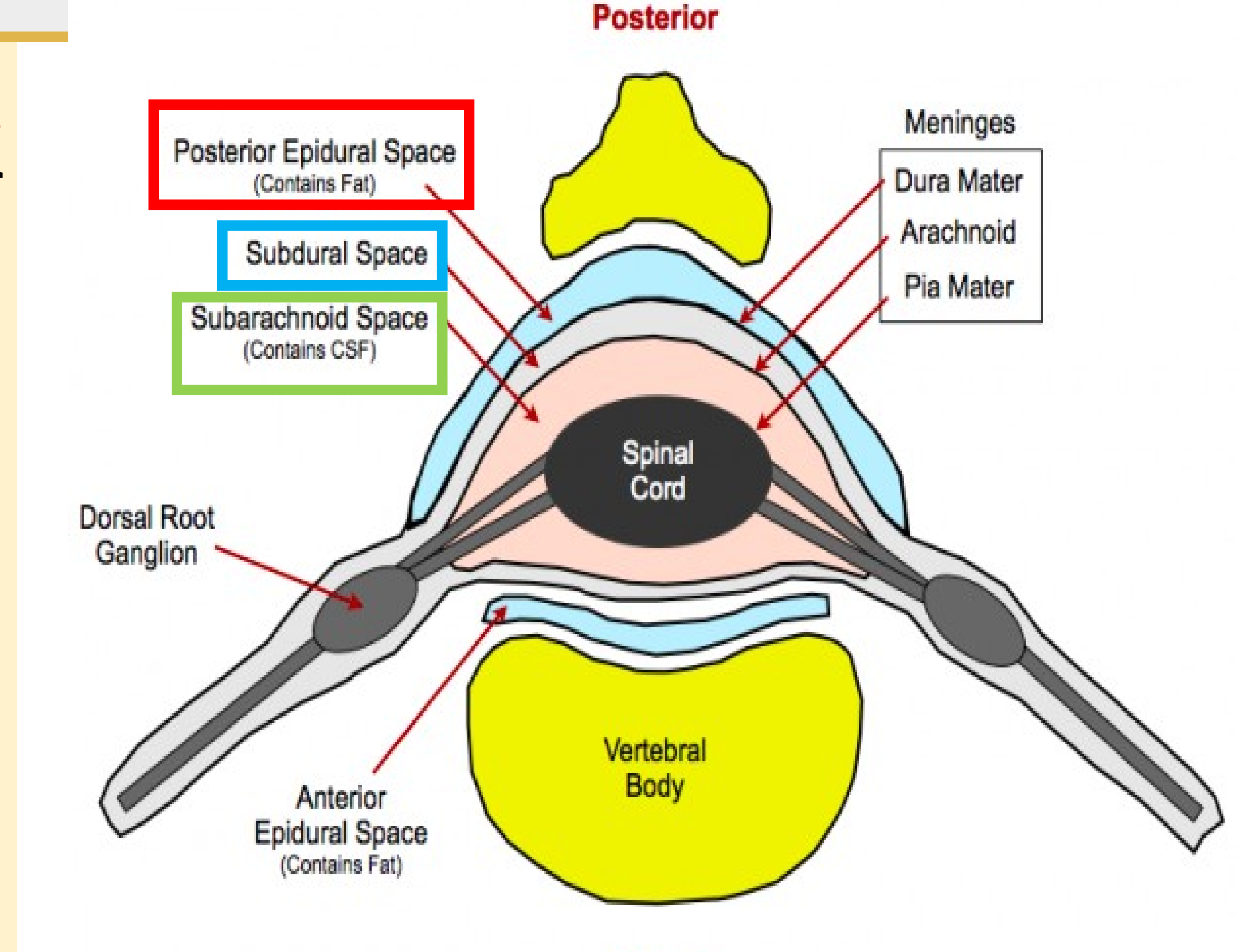
- 2. **Pia mater (inner layer)** is adherent to the cord & continues below as the ***filum terminale*** which **pierces the tube of dura & arachnoid** to be attached to **the back of**

Spaces Between the Spinal Meninges

1. **Extradural (epidural) space:** **between the dura and walls of vertebral canal. Contains fat, small arteries, venous plexus & lymphatics.**

2. **Subdural space:** **between the dura & arachnoid. Contains a thin film of fluid.**

3. **Subarachnoid space:** **between**

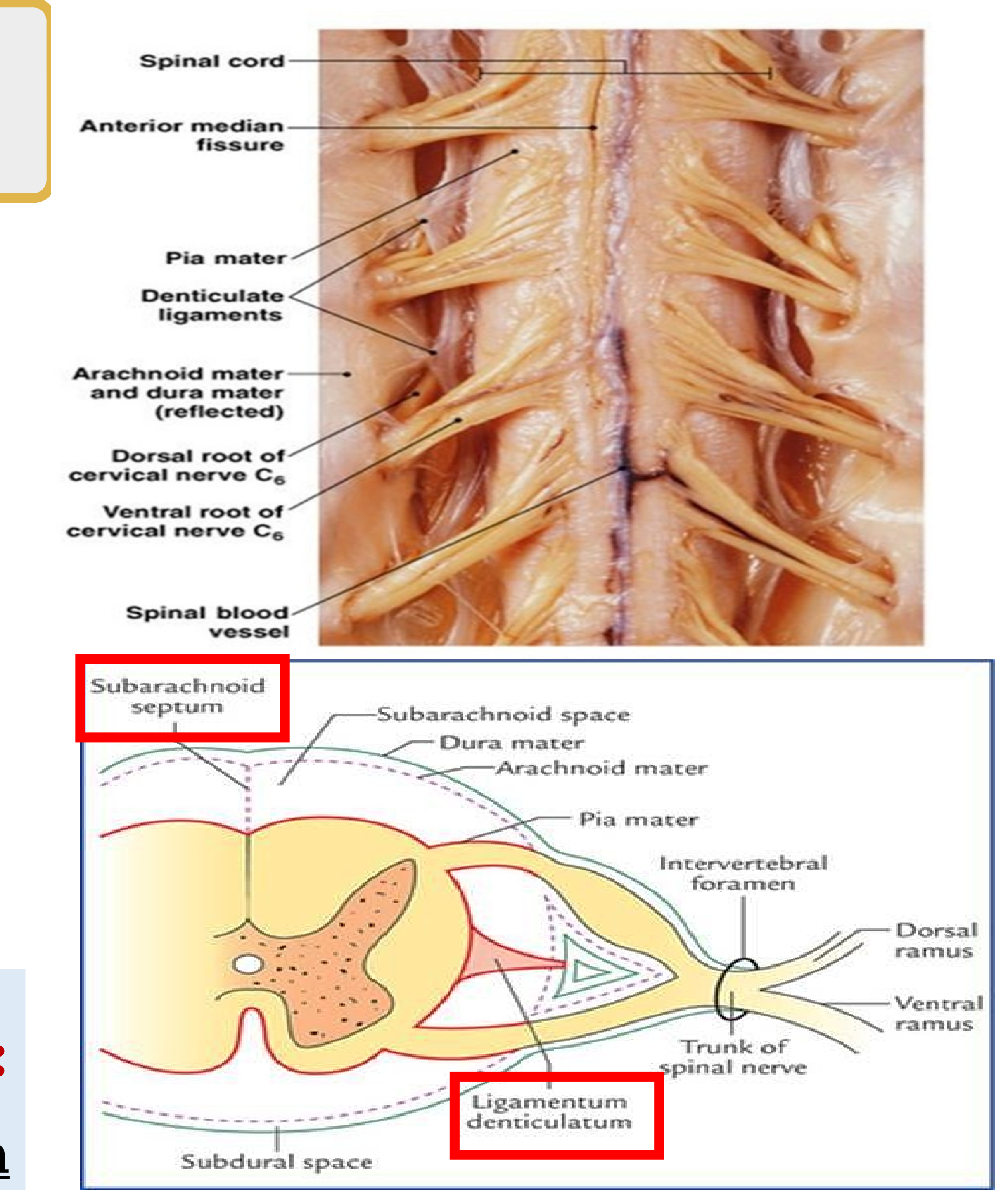


3 Ligaments Supporting the Spinal Cord

1- Filum Terminale.

2- Ligamentum Denticulatum: one on each side of the cord, extending laterally **between the anterior and posterior roots of spinal nerves**.

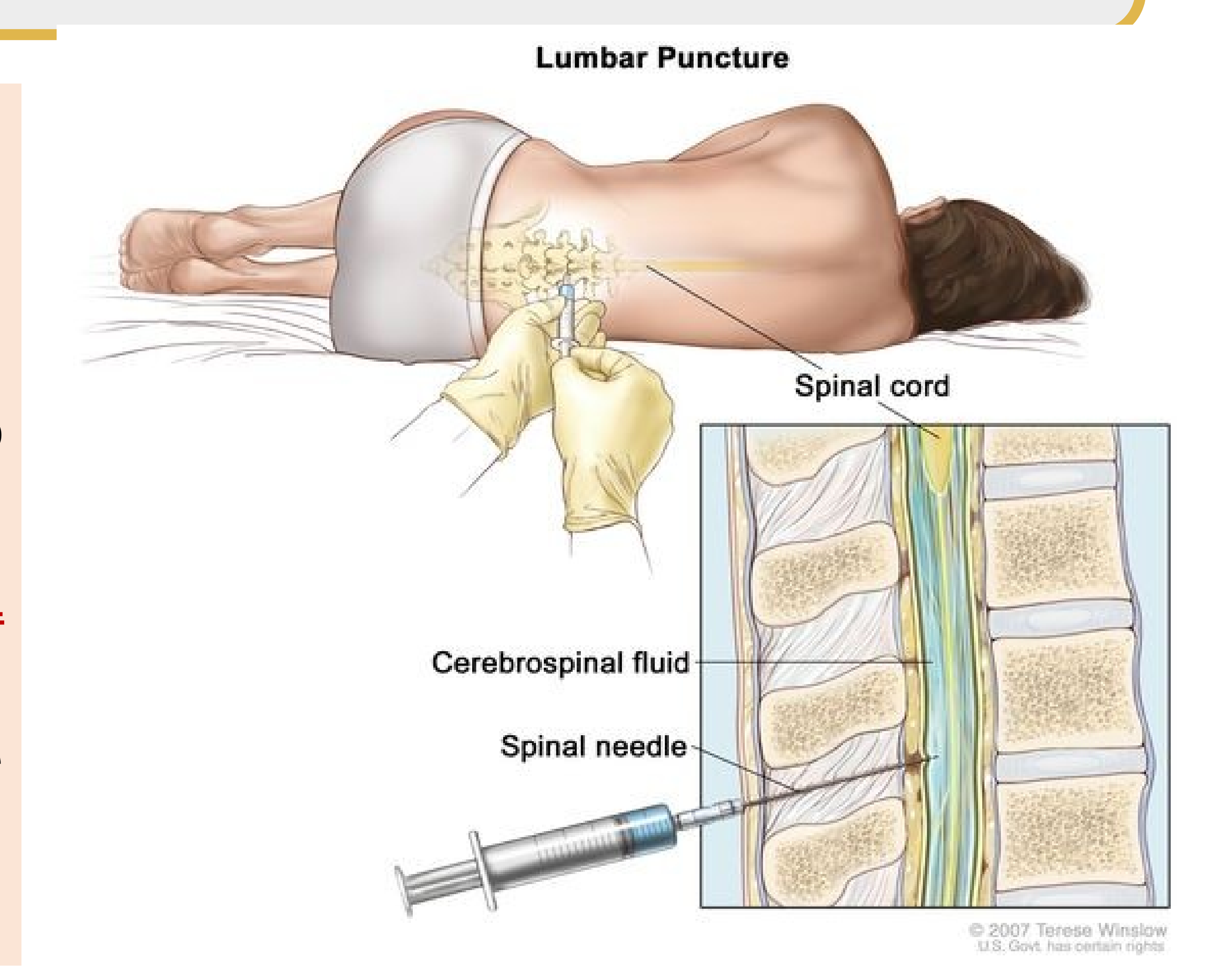
3- Subarachnoid Septum: extends from the **posterior median**



The Lumbar Puncture

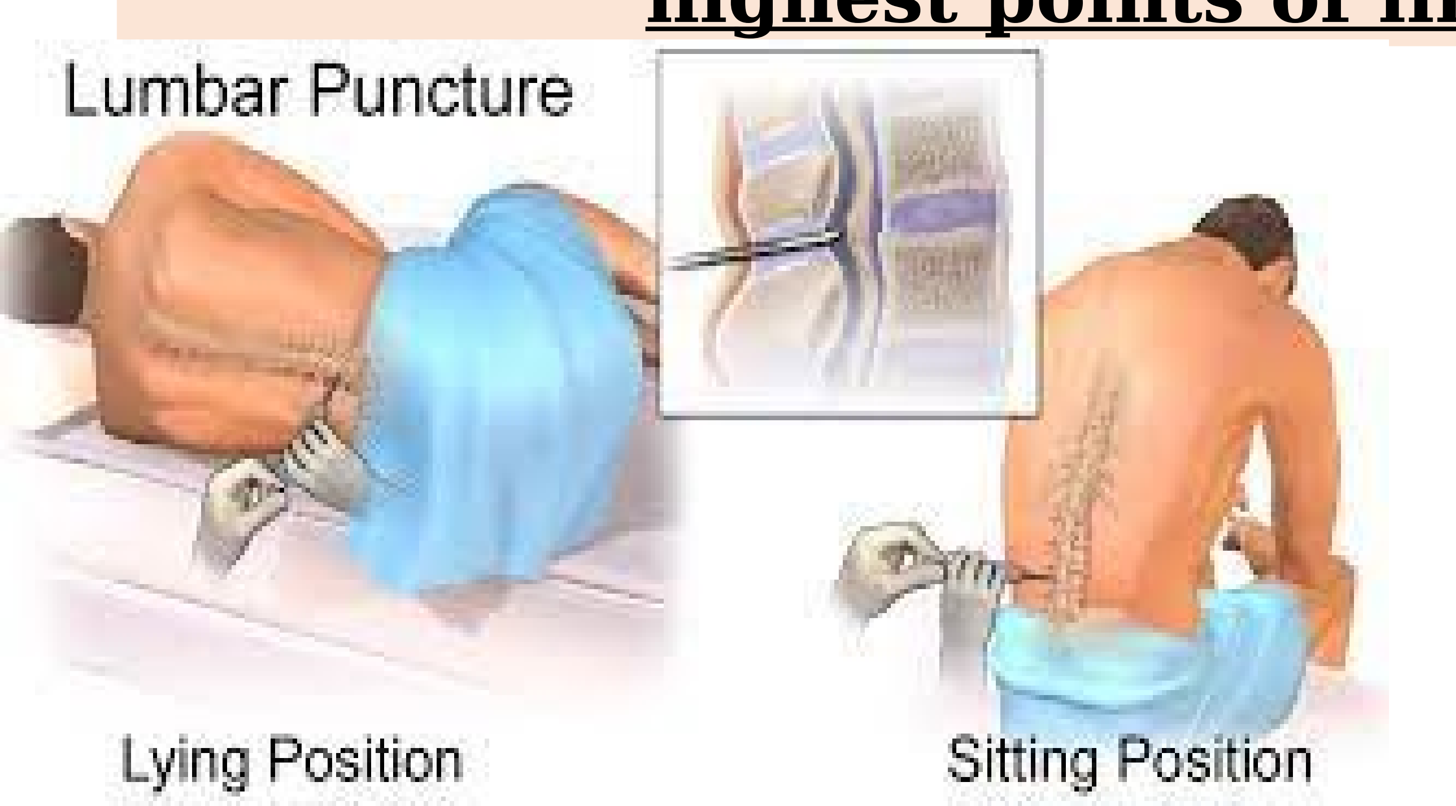
➢ **Technique**

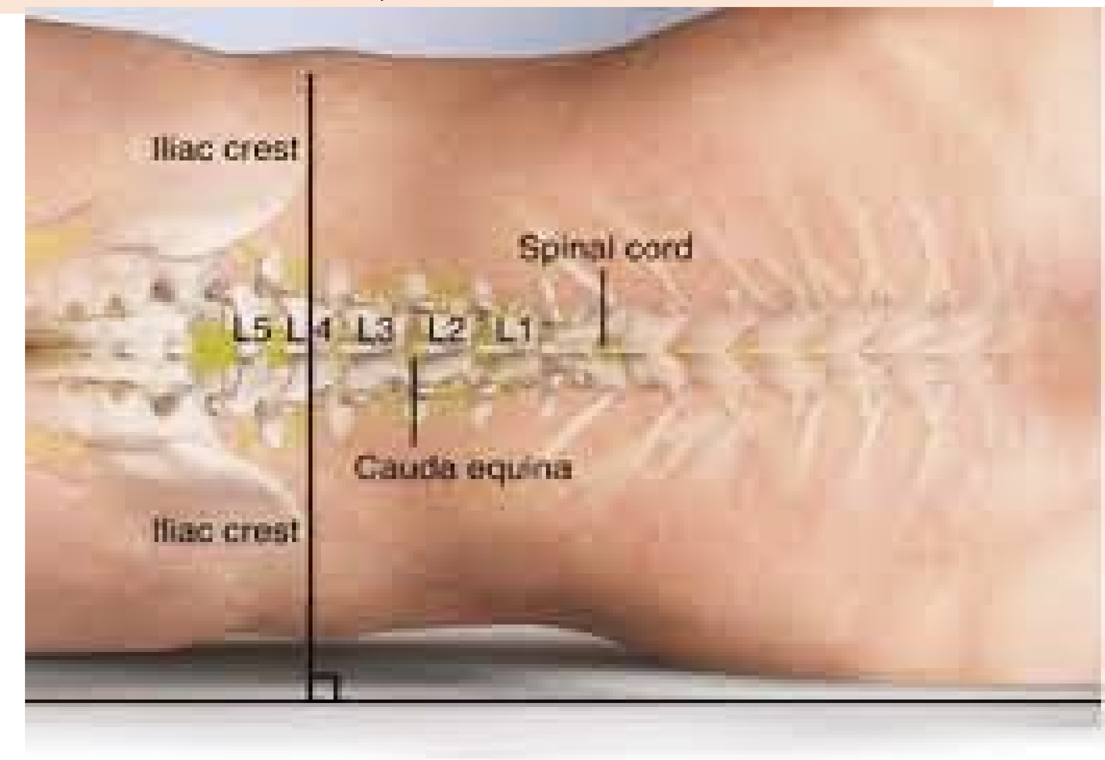
A needle is introduced to the spinal subarachnoid space below the end of the spinal cord.



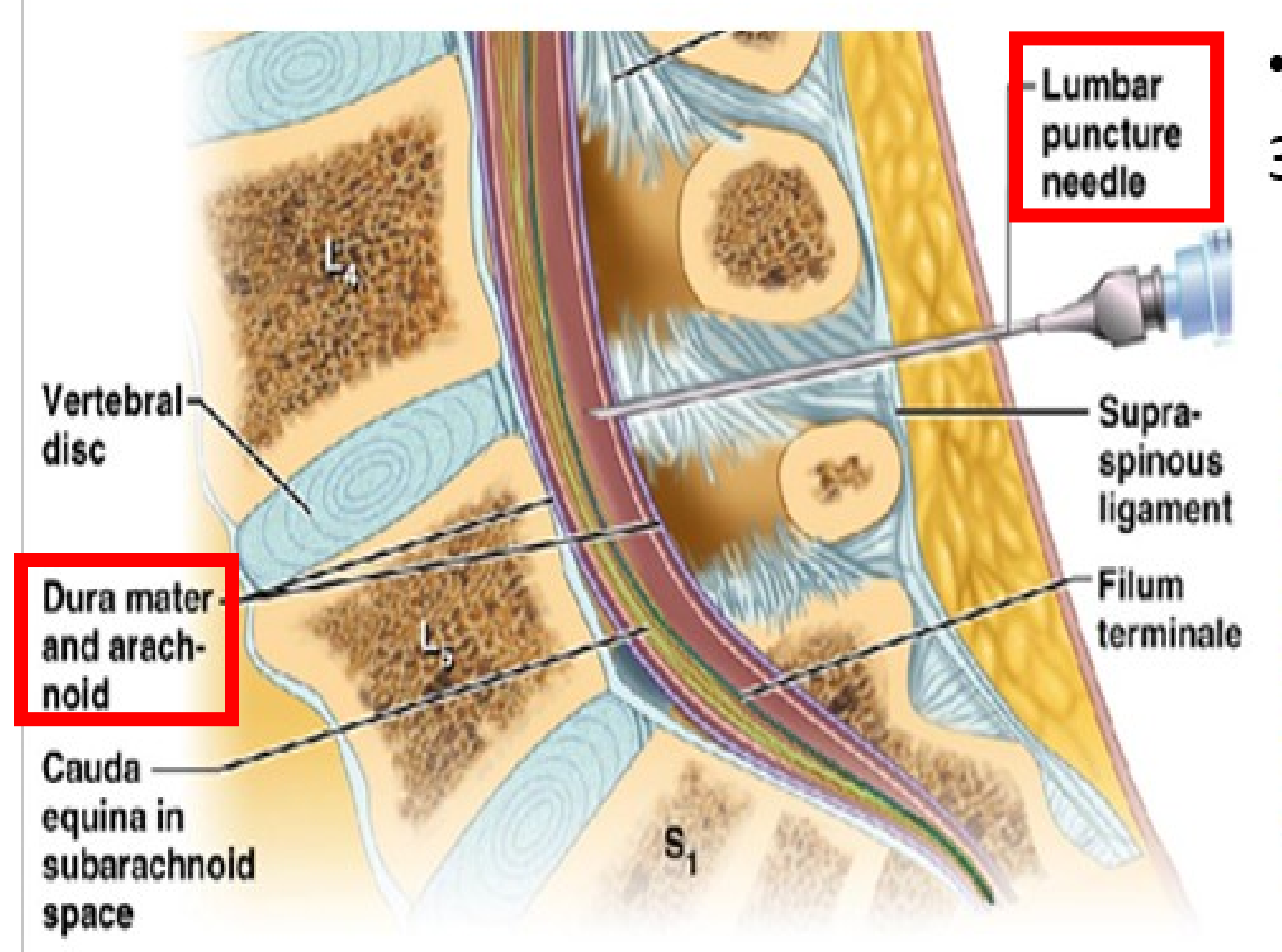
Site of the Lumbar Puncture

Just above or just below the tip of 4th lumbar spine (which lies opposite an imaginary line connecting the highest points of iliac crests).





The Lumbar Puncture



- **Technique:**

3- The following structures are punctured from superficial to deep:

a. Skin.

b. Fasciae

c. Supraspinous lig.

d. Interspinous lig.

e. Dura

f. Arachnoid

Uses of the Lumbar Puncture

1. Diagnostic:

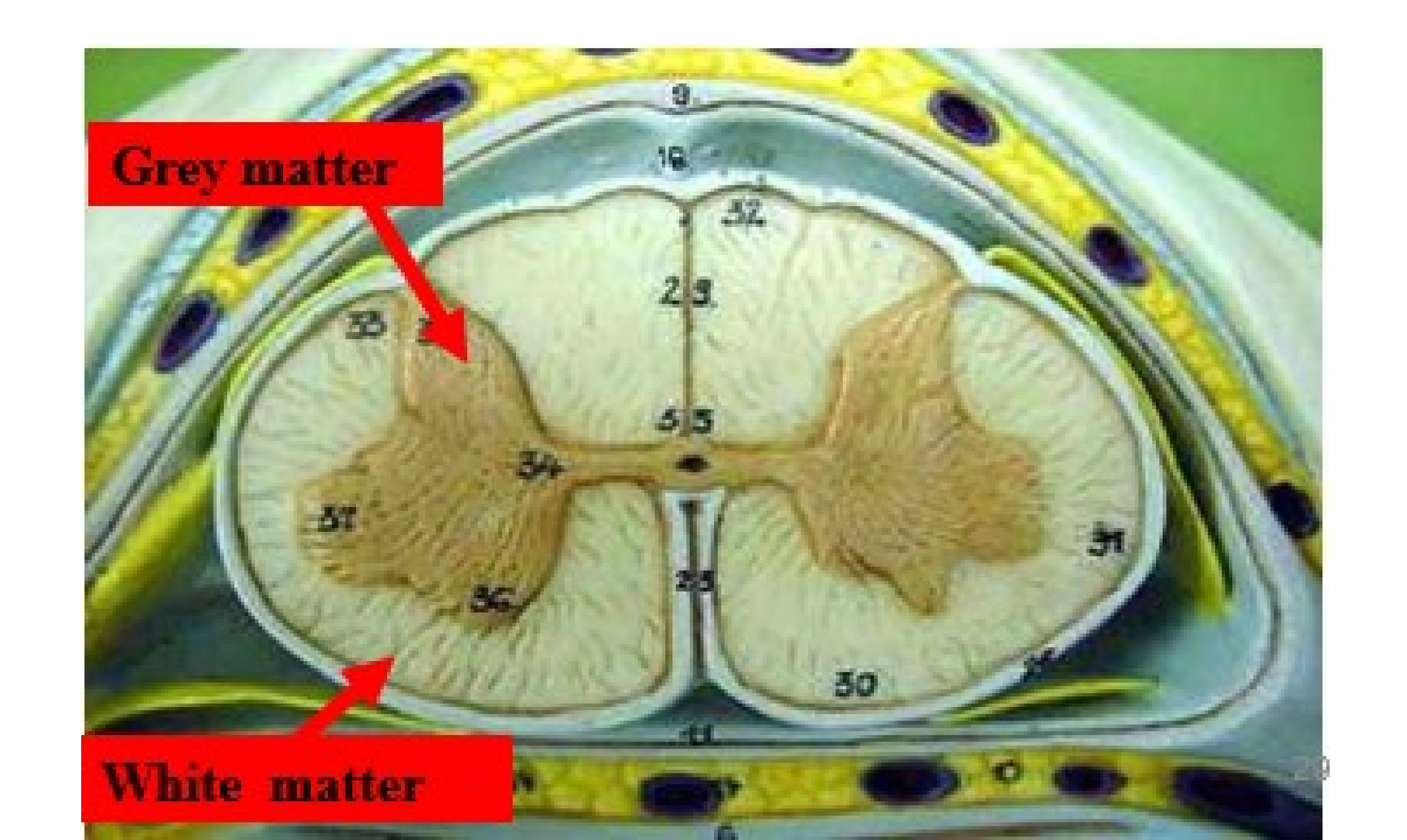
- **Measuring CSF pressure.**
- **Obtain sample for analysis (meningitis).**

2. Therapeutic:

- **Remove some CSF to relieve increased intracranial tension.**
- **Inject antibiotics or spinal anesthesia.**

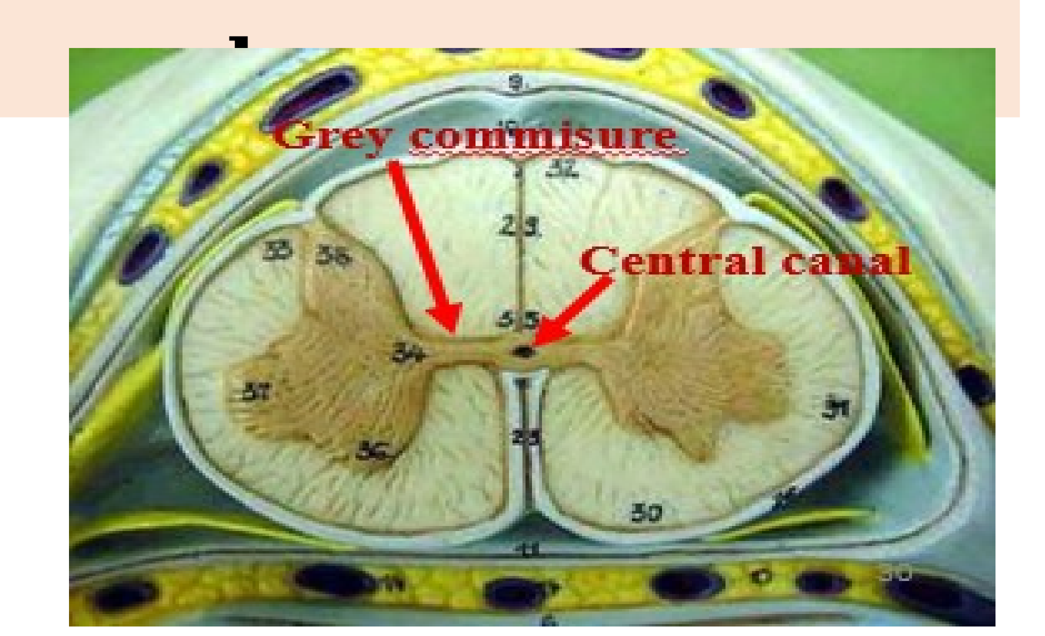
Internal Structure of the Spinal Cord

The spinal cord is formed of a central H-shaped grey matter surrounded by white matter



Internal Structure of the Spinal Cord

- **Its center contains a narrow central canal extending throughout the length of spinal**



Grey matter
White matter
Central canal
Dorsal root ganglion
Dorsal root
Ventral root
Pia mater
Arachnoid mater
Dura mater
Spinal meninges

Cross Section of the Spinal Cord

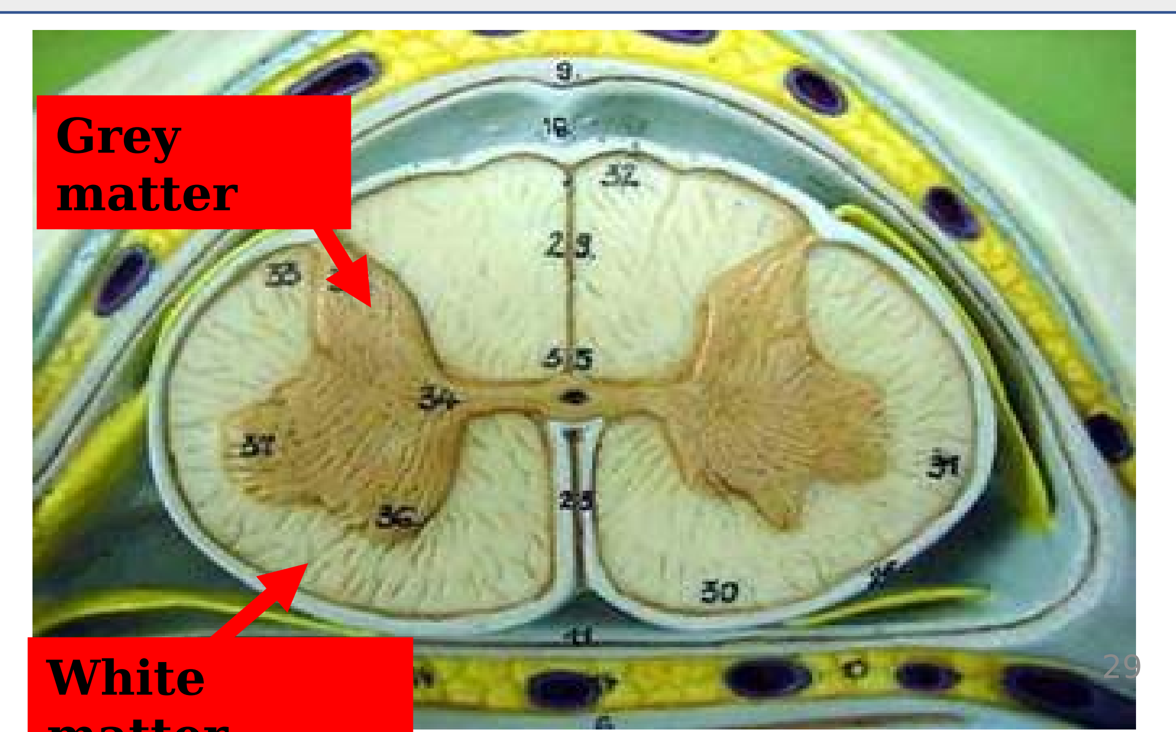
I- Grey matter (H-shaped):

Contain the cell bodies (neurons).

II- White matter:

Surrounds the grey matter and contain nerve fibers which run as tracts (Ascending tracts: carrying sensations to the brain and Descending tracts: carrying motor orders from the brain).





Cross Section of the Spinal Cord



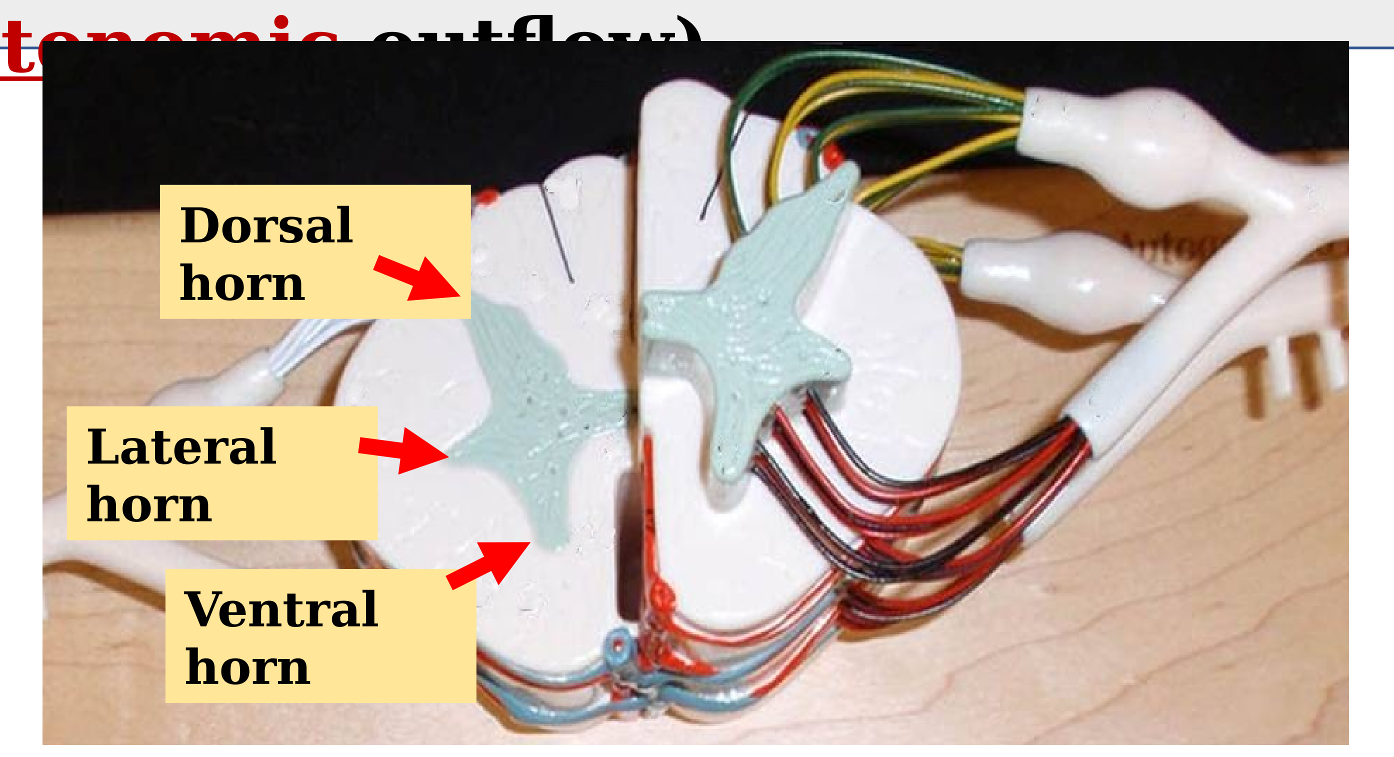
➢ Grey matter:

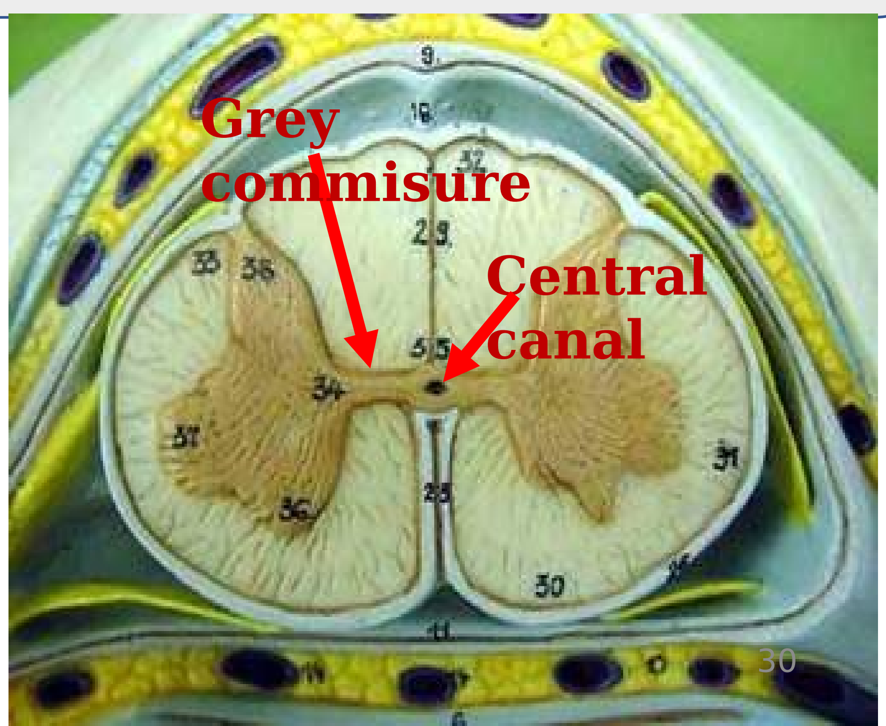
- The internal part, contain the cell bodies (neurons) it projects as:

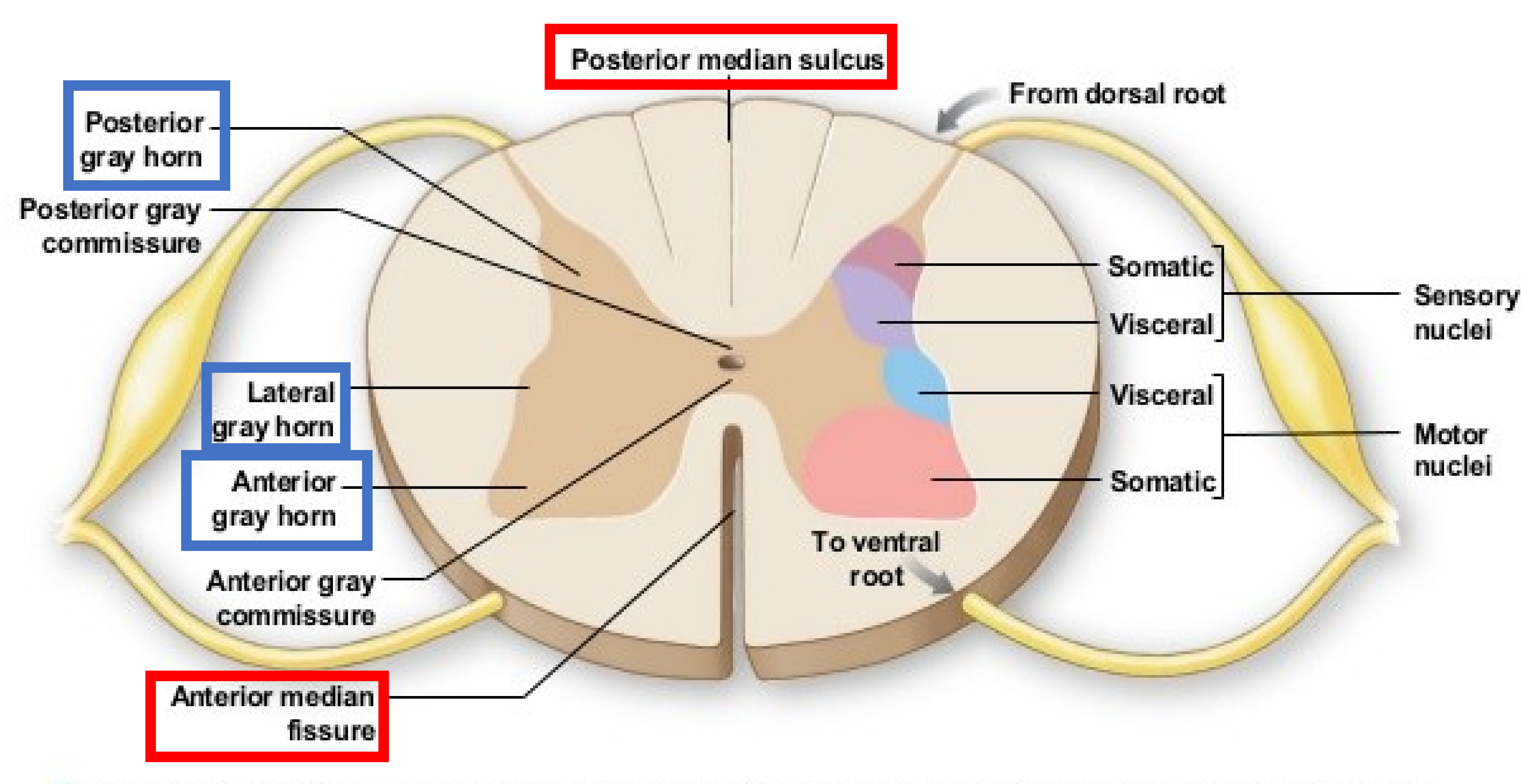
    A- 2 dorsal horns (contain sensory neurons).

    B- 2 ventral horns (contain motor neurons).

    C- 2 lateral horns (found only in segments which give autonomic outflow).



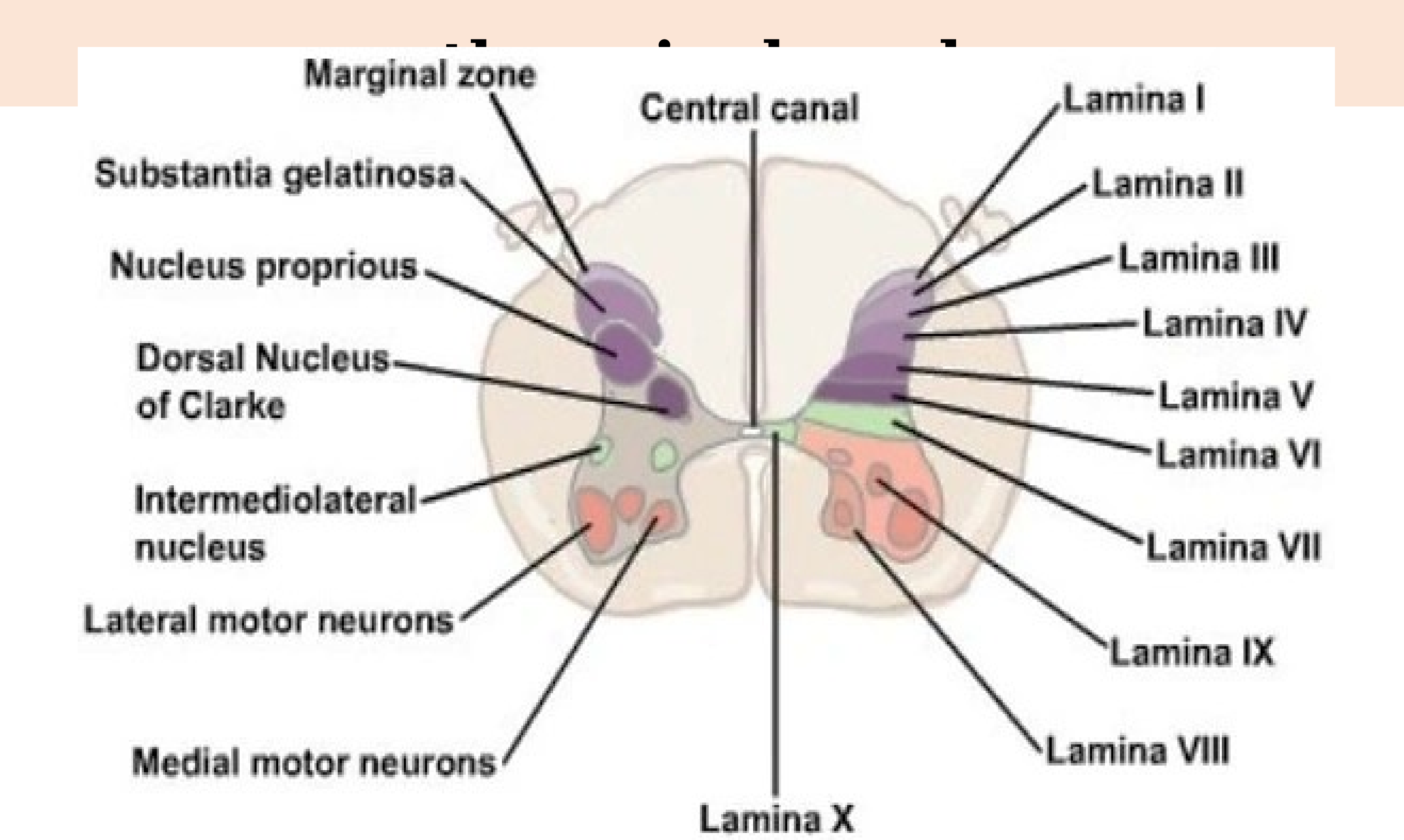




b The left half of this sectional view shows important anatomical landmarks; the right half indicates the functional organization of the gray matter in the anterior, lateral, and posterior gray horns.

Grey Matter Laminae of Rexed

“ Rexed” described <u>10 Laminae</u> in the grey matter of



Attachments of the Spinal Nerves

Each spinal nerve arises from a spinal cord segment by 2 roots:

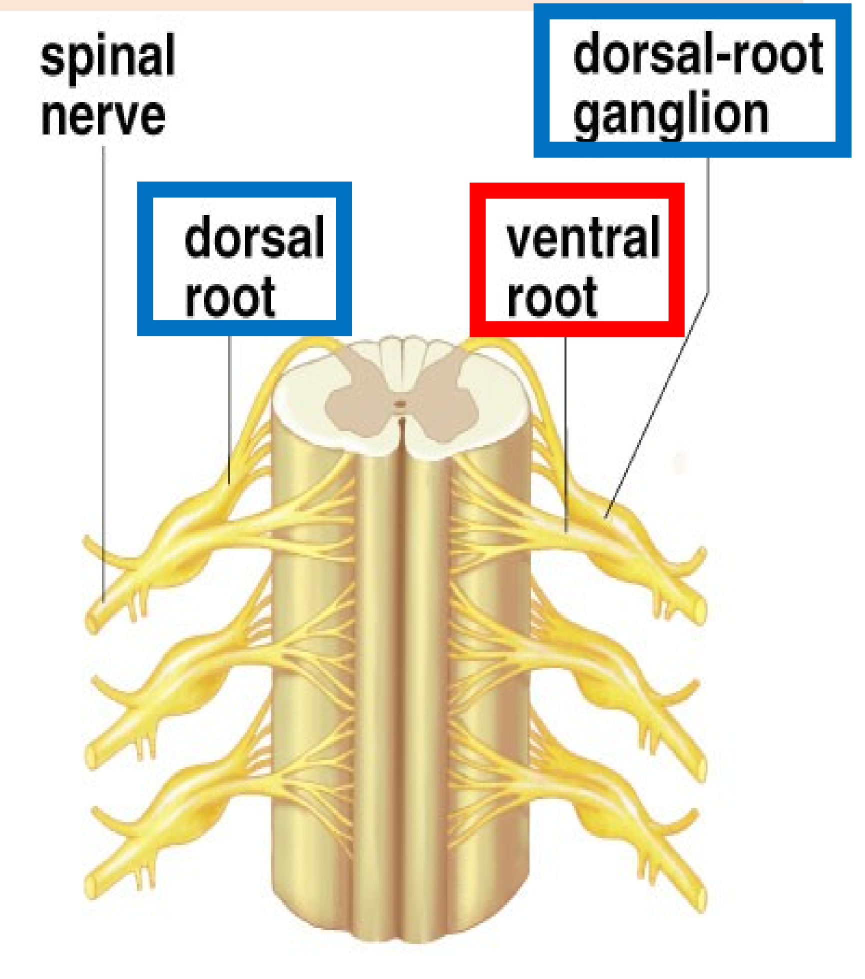
1. Ventral root: contains

- ***Motor*** **fibers (from the anterior horn)**
- **± *Autonomic*** **fibers (from the lateral**

2. Dorsal root: purely *sensory.*

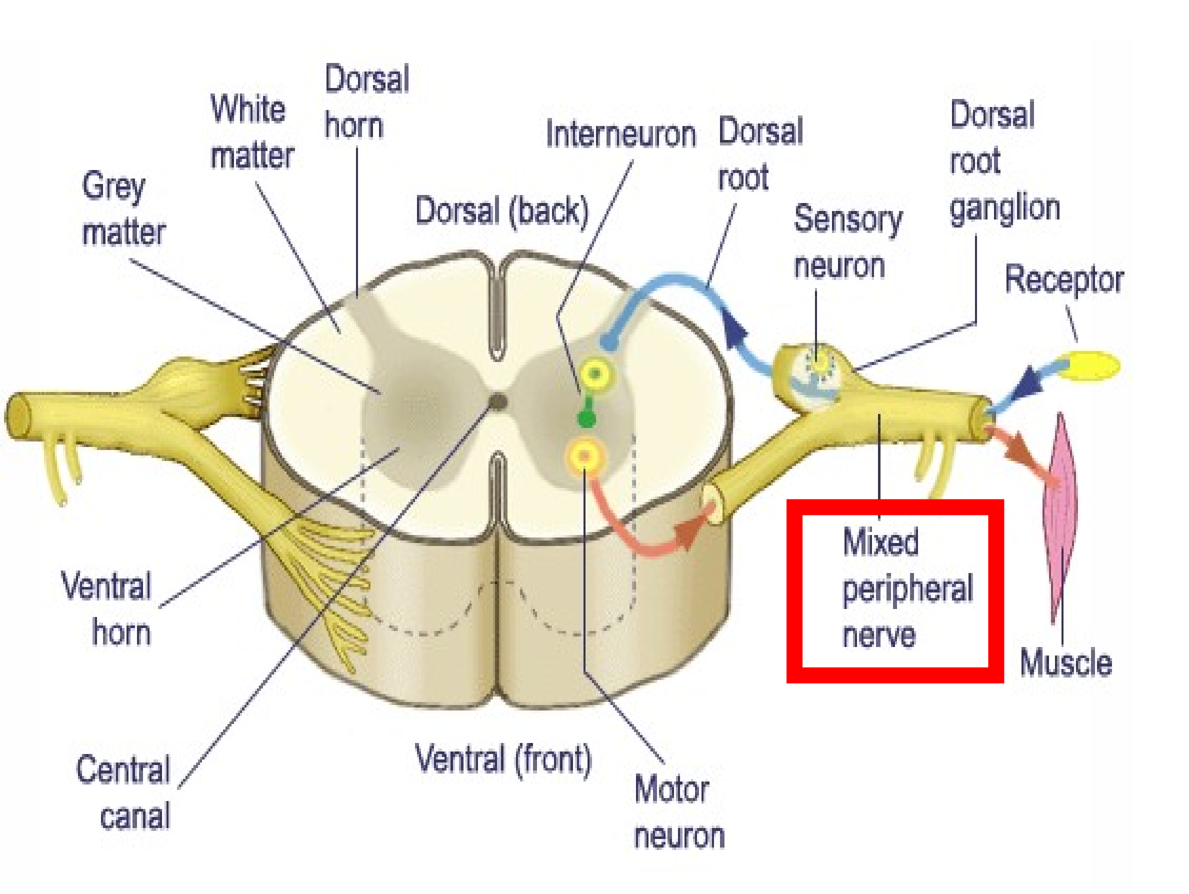
Carries Dorsal root ganglion (spinal ganglion) containing *pseudounipolar neurons*.

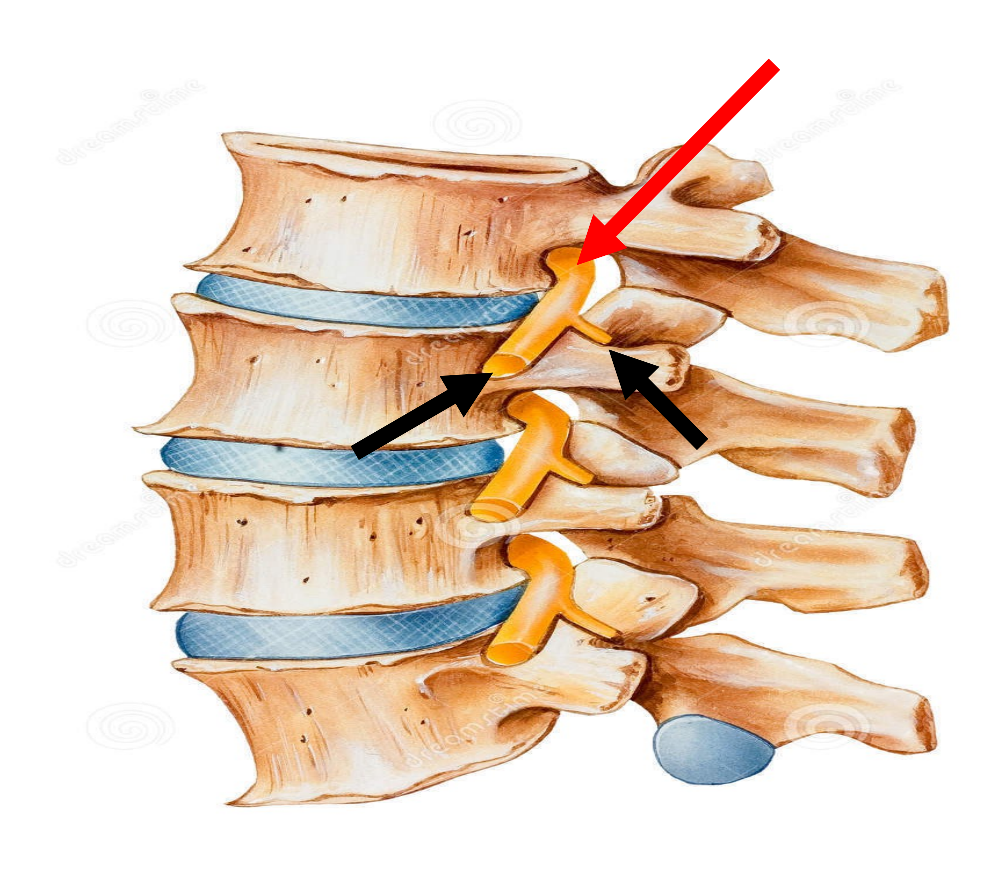
- **Their peripheral processes (dendrites) pass peripherally.**
- **Their central processes (axons) enter the**



Attachments of the Spinal Nerves

Both roots unite forming <u>a mixed nerve</u>, which exits the vertebral canal through the <u>intervertebral foramen (IVF)</u> and soon divides into <u>2 rami</u> (both are <u>mixed</u>)

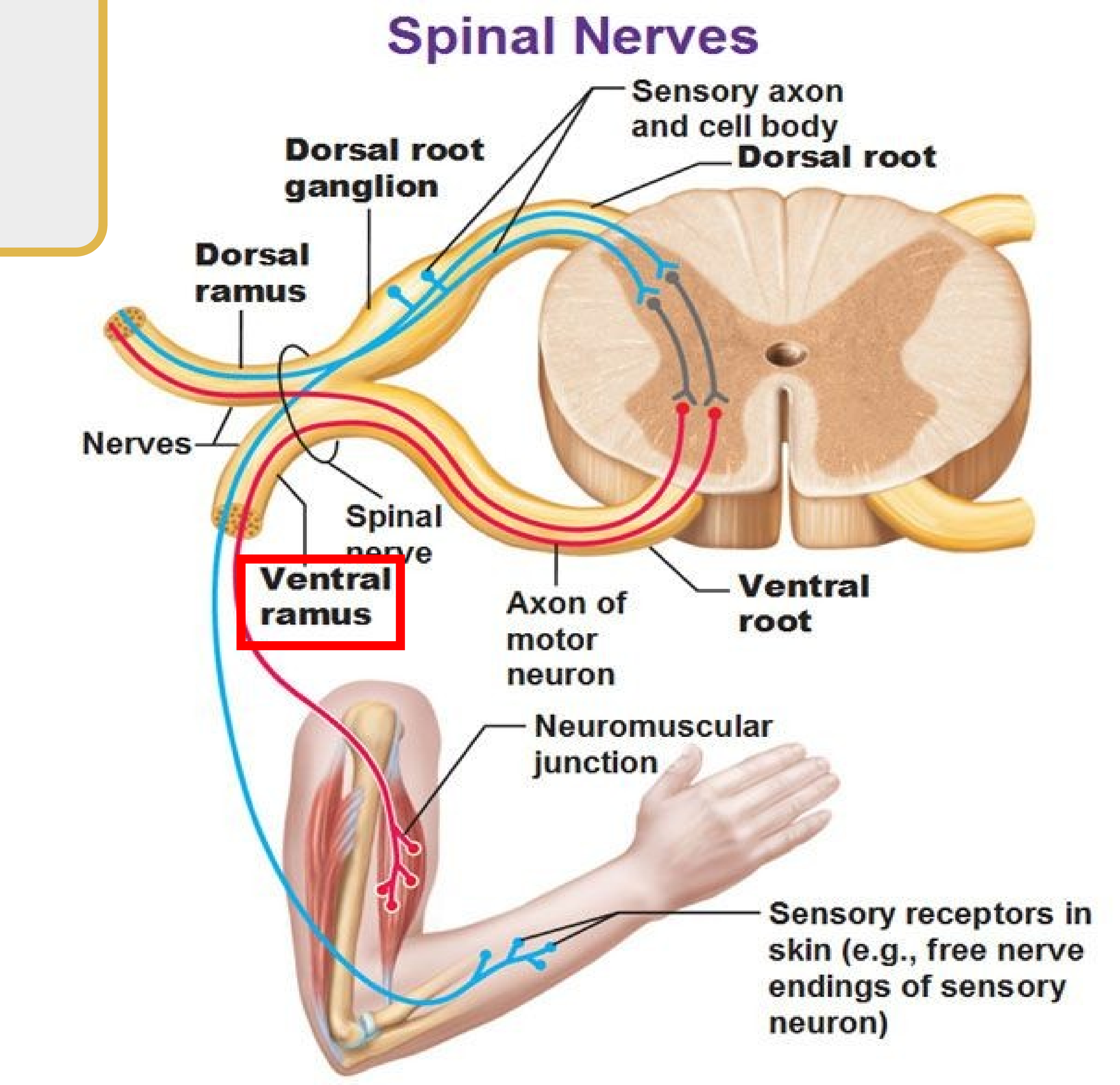




Anterior Ramus

- <u>**Large, Mixed**</u>

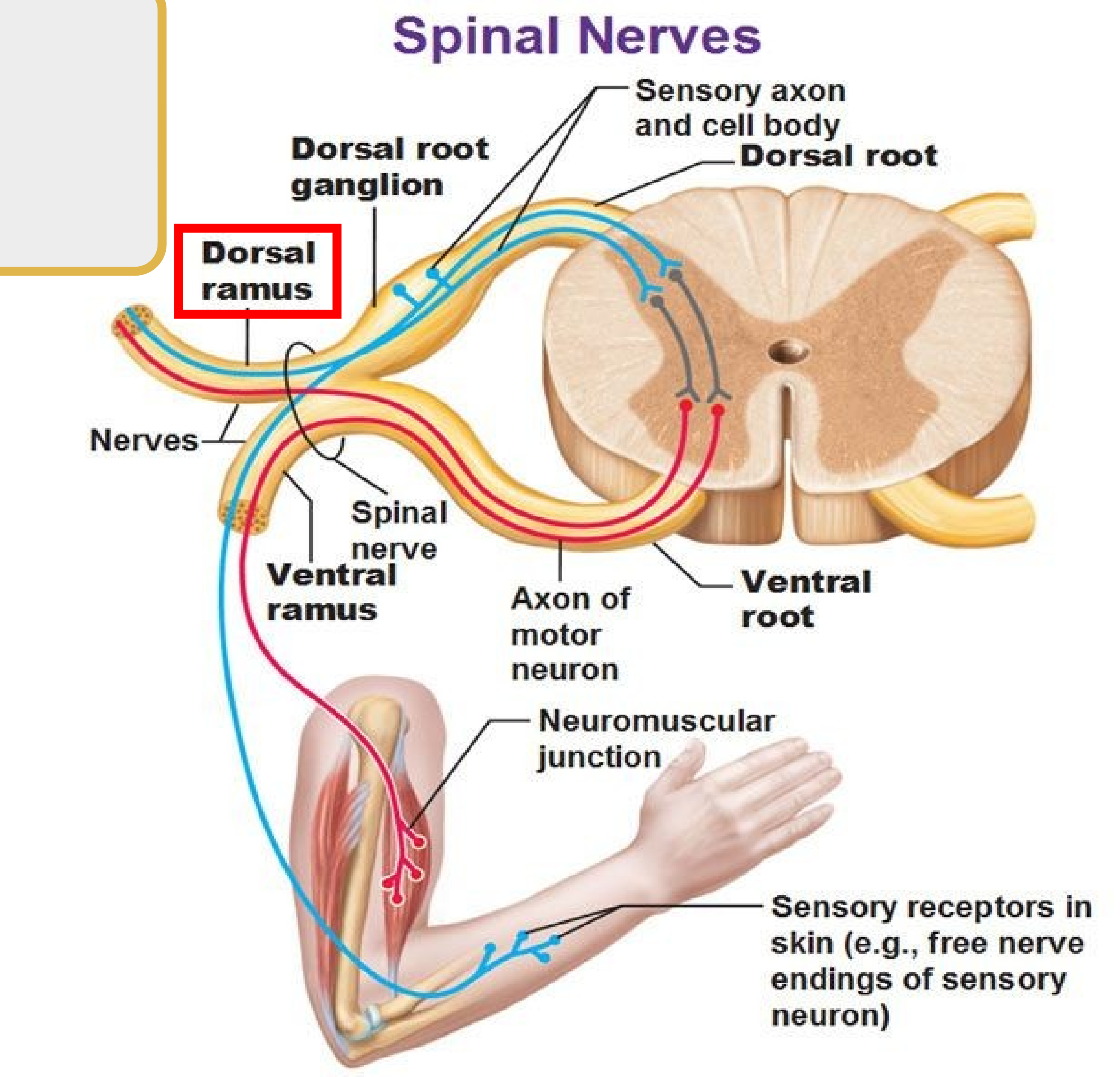
- **Pass anteriorly to supply the <u>muscles and skin</u> of the <u>anterolateral body wall</u> and all muscles and skin of the <u>limbs.</u>**



Posterior Ramus

- **Small, Mixed**

- **Pass posteriorly to supply muscles and skin of the back.**



SUGGESTED TEXTBOOKS



Clinical Anatomy for Medical Students .Richard S. Snell

Gray’s anatomy for students .


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THANK YOU